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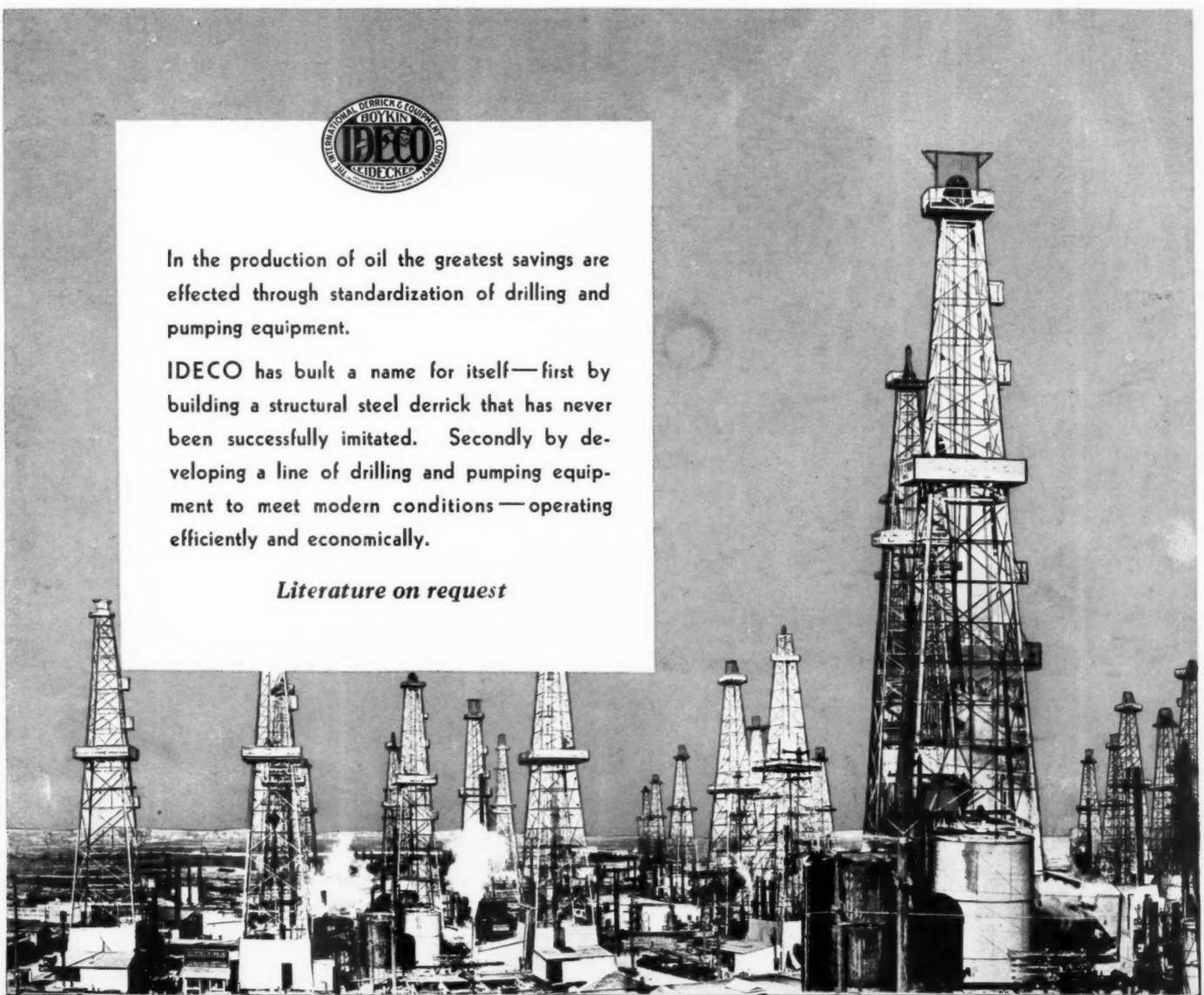

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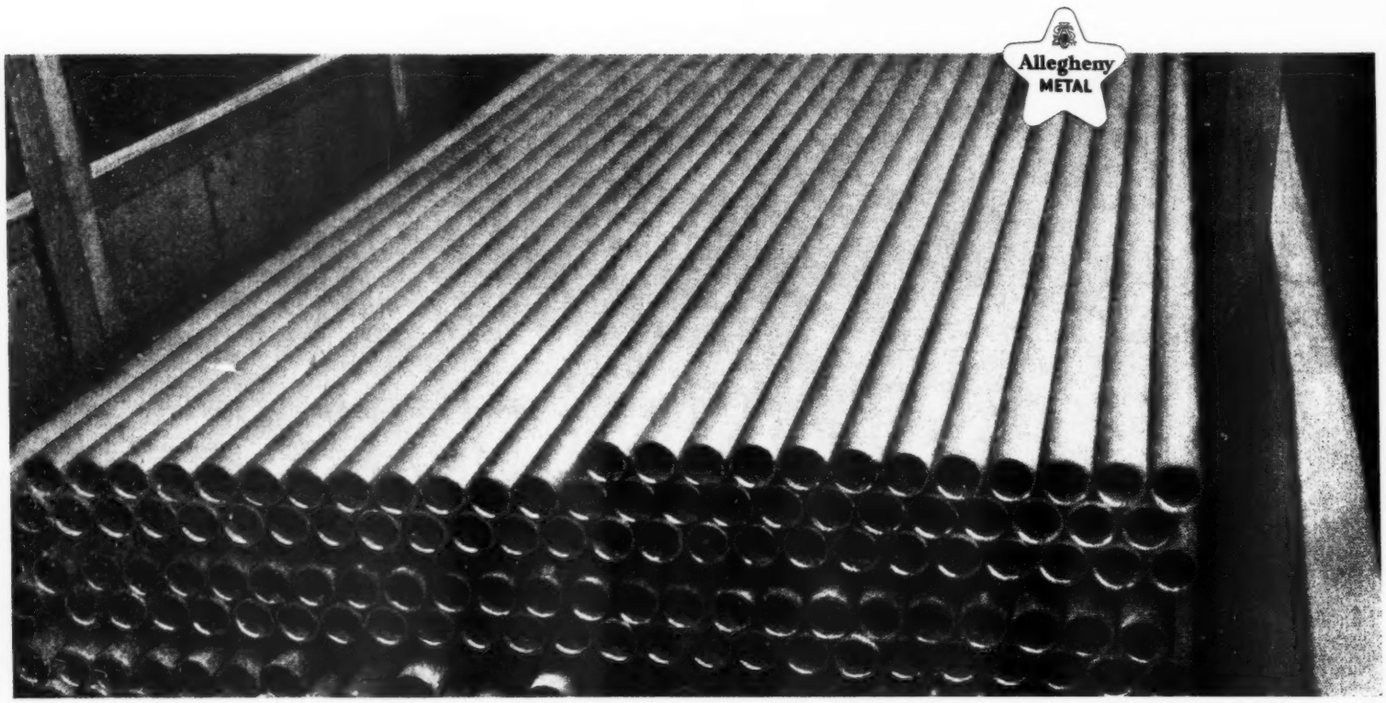

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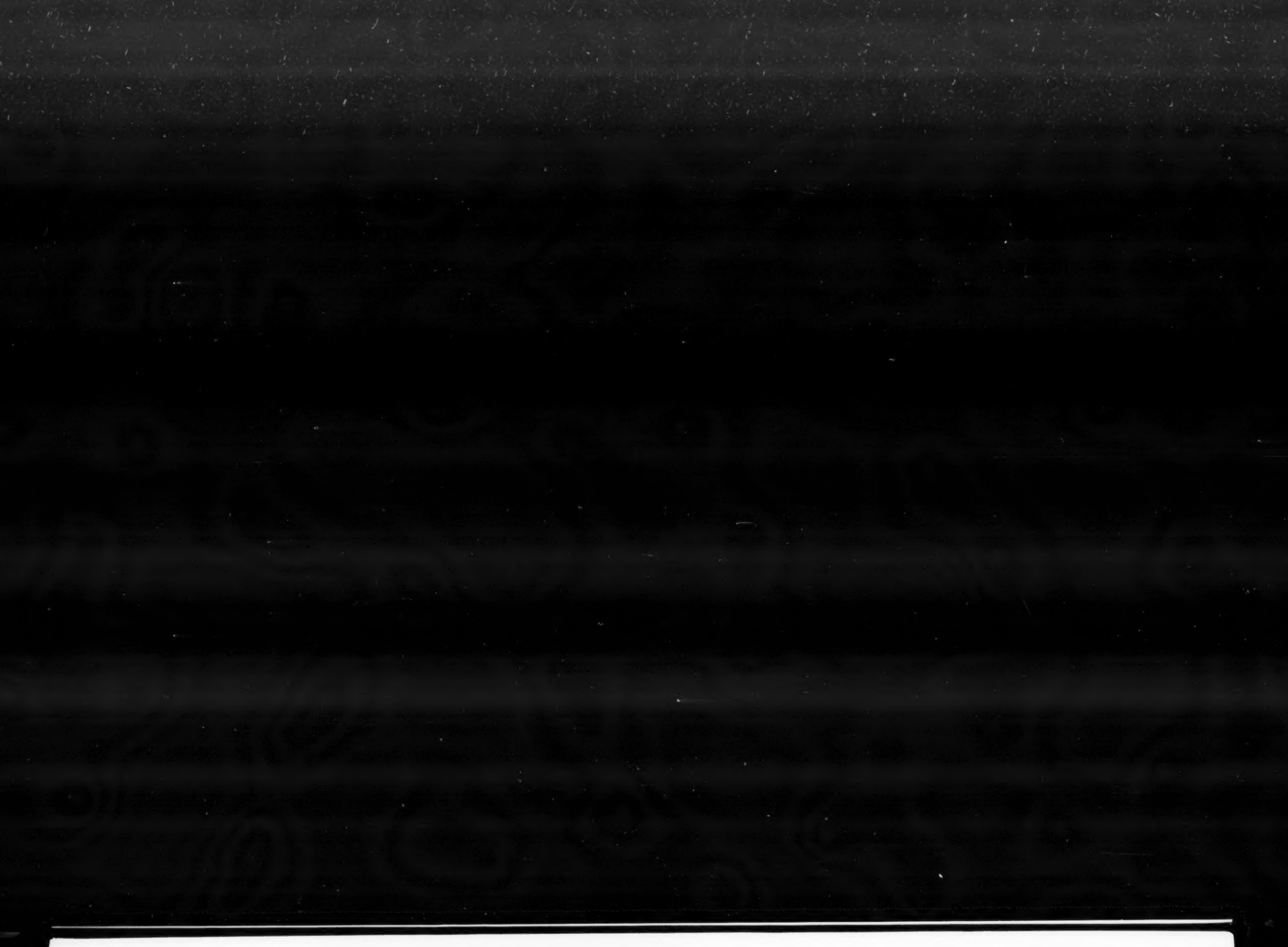

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Most Oil Men Favorable to Proration

Highest production in 1930, week ending Feb. 22, average daily output 2,699,096 bbls. Peak of U. S. production, week ending Aug. 24, 1929, average 2,975,435 bbls.

Few That Oppose It Causing an Unsettled Condition in What Is Otherwise a Favorable Situation

Lowest daily average crude oil production in the United States during 1930 was for week ending Dec. 27 with average output of 2,144,074 bbls.

By James McIntyre

Crude oil production, which had been mounting steadily since January 31 took a downward turn in the past week, the total crude output in the United States having been 55,673 bbls. per day below that of the week previous. A drop of 40,525 bbls. per day in the Oklahoma City Field and 17,580 bbls. per day in the Greater Seminole area in Oklahoma more than accounted for all the decline. A slowing up of operations in both fields in the last week of the month to make up for overproduction earlier in the period was the cause of the decline in both big fields.

Strenuous efforts on the part of a very few interests in Oklahoma to weaken or destroy proration in that State and the work of antiprorationists in East Texas, together with a few local and minor crude oil price cuts in North Texas, Oklahoma and Kansas have created a feeling of unsettlement that pervades the whole industrial structure. Statistically the production and refining branches of the business are in favorable condition.

In all the States where production is being curtailed in order to keep a flood of useless oil off the market, a large majority of oil men are in favor of keeping the lid on in the big producing pools. Particularly is this true of the small producer, of whom there are thousands, and who feel that they will face ruin if big fields like Oklahoma City and East Central Texas are permitted to produce without restraint. The California curtailment committee comes out in favor of continuing production on a basis of refinery demand and meetings in Oklahoma bring out a very strong sentiment in favor of holding back the possible production flood.

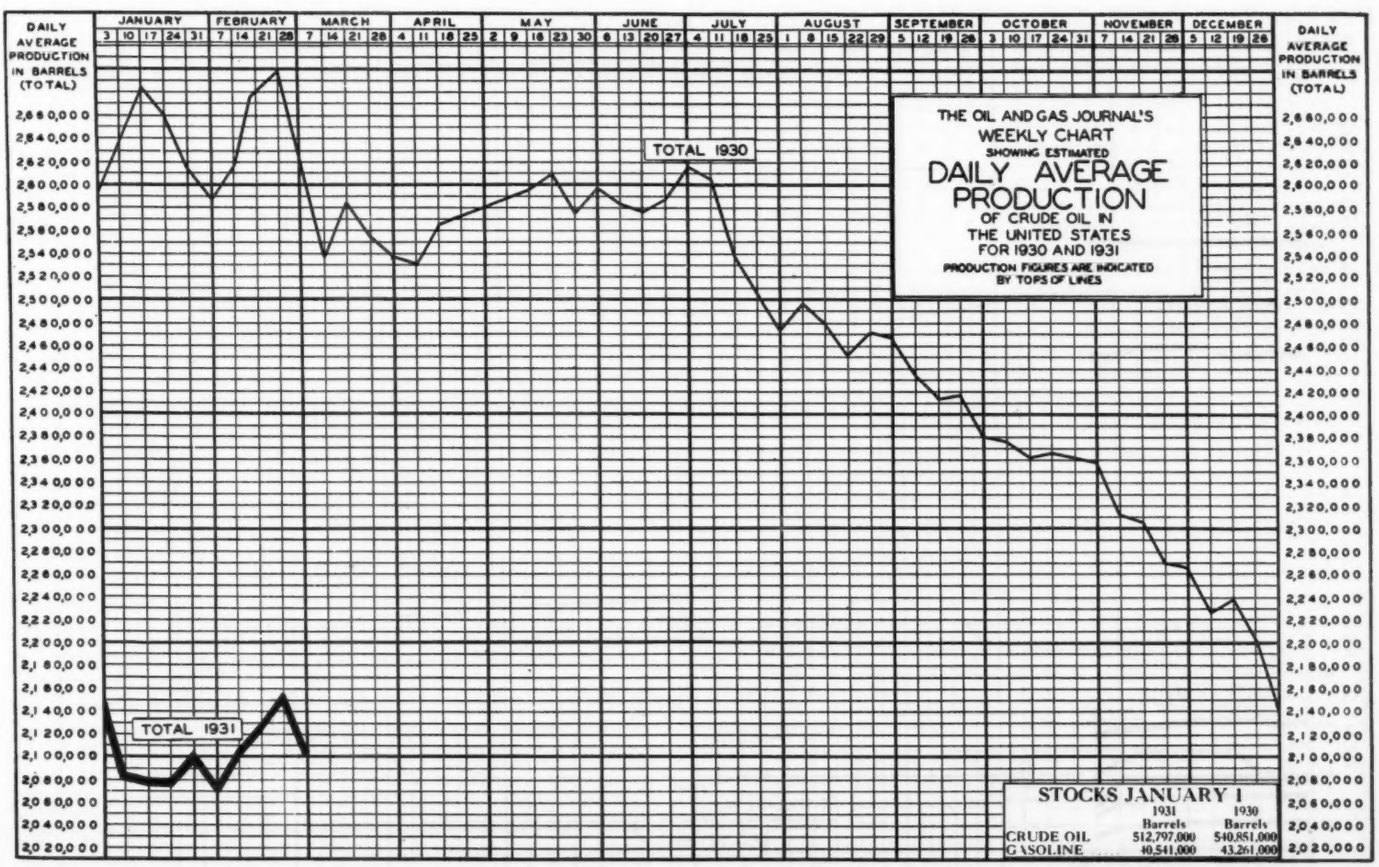
The governors of Oklahoma and Texas, and representatives of the governors of Kansas and New Mexico, met in Fort Worth, Tex., in the past week and after sessions lasting 13 hours wired President Hoover and the heads of companies importing oil and its products urging a meeting to consider the matter of limiting imports. The governors also adopted a resolution favoring an oil states advisory committee that will sponsor a conservation program backed by legislation that will make it possible to enforce the program.

PRODUCTION IN THE UNITED STATES

Estimated daily average production of crude oil in the United States for week ended February 28 and a comparison with the previous week follows:

	Feb. 28	Feb. 21
Oklahoma—		
Oklahoma City	65,590	106,115
Seminole-St. Louis	146 760	164,340
Remainder of State	232,600	231,580
Total Oklahoma	444,950	502,035
West Texas—		
Hendricks	50,194	51,740
Yates	95,631	92,283
Remainder	99,528	101,797
Total West Texas	245,353	245,820
North Louisiana	42,815	44,880
Arkansas	50,055	49,840
North Central Texas	84,267	82,698
Texas Panhandle	53,175	50,010
East Central Texas	75,966	67,988
Kansas	112,720	115,870
Total Mid-Continent area	1,109,301	1,159,141
Gulf Coast	178,114	177,448
Southwest Texas	83,333	85,547
Eastern	109,250	108,000
Rocky Mountain area	98,613	100,148
California—		
Santa Fe Springs	72,000	71,000
Long Beach	92 250	93,750
Playa Del Rey	31,000	32,500
Elwood	30,750	31,000
Ventura Avenue	44,000	45,000
Kettleman Hills	25,500	26,000
Remainder of State	229,000	229,250
Total California	524,500	528,500
Total United States	2,103,111	2,158,784

→ **Decrease 55,673 Bbls. Daily** ←



Increase in Demand is Principal Hope

Further Price Shading Resorted to as Means of Moving Excess Stocks in View of Uncertain Future

By W. T. Ziegenhain

Additional quantities of gasoline, kerosene and gas oil are being offered at prices below the range of a week ago by several refiners in the Oklahoma (Group 3) area, tending to further weaken the entire price structure. Natural gasoline is also openly quoted one-quarter cent below the market of a week ago and small quantities are being offered to jobbers for delivery over the month at still lower prices, indicating skepticism in the belief that prices will recover in the immediate future.

The general fuel oil market has remained unchanged but distress material appears from time to time on which price concessions of 2½ to 5 cents are given but not in sufficient quantities to justify lowering the general market. Lubricating oils, cylinder stocks and bright stocks are moving slowly, very little additional business having developed as a result of price reductions a week ago.

Fear of the future, in regard to the ability of the industry to uphold proration and the posting of lower tank wagon and station prices on gasoline in California and the increase in the dealers discount in the Standard Oil Co. of New Jersey, coupled with the lowering of the tank car price along the East Coast by the Atlantic Refining Co. and the Continental Oil Co. and the abnormally slow export movement of gasoline from the Gulf Coast, all tended to influence refiners to "liquidate" whatever excess stocks are on hand.

News of the rapid developments in the East Texas fields with respect to drilling and the building of new refineries presented during the week also dampened the hopes of many who believed that a recovery to normal would follow February, the consistently "poor" month of the year.

East Texas Developments

Cheap crude and plenty of it seems to be taken for granted if all of the plants are to be built in the East Texas fields that are now being planned. At least a dozen projects are now under way, which if carried out, would add 45,000 bbls. of new refining capacity to this area. Practically all of the products will have to be offered for sale in the north central and southeast states in direct competition with Group 3 and North Texas refiners which causes this interest among the other refiners.

One salesmanager offered consolation by the fact that prices are now below the level for all times and a turning point was bound to come as soon as the early spring demand for gasoline develops. Jobbers are generally known to have gone through the winter buying from hand to mouth and are not buying now because they do not know what to expect to come from the entanglement of opposing ideas and efforts now being expended among producers, and marketers.

On the other hand, refiners have been successful in holding gasoline stocks below those of a year ago and near the figure established by the American Petroleum Institute. It is discouraging to find that a part of this showing is caused by several refiners curtailing their present runs in anticipation of being able to buy crude at reduced prices in the near future and will then run their plants to capacity to fully make up for the present program. How successful the latter program will be, is entirely dependent upon the ability to uphold proration as its problems seem to be increasing almost daily.

Gasoline

The fact that a quotation on gasoline now represents more than the price of the material itself accounts for the present widespread difference between the low and the high on gasoline quotations. Those refiners offering trademarked advertised products, etc., are holding to 4¾ cents for their U. S. Motor grade while usually, the smaller refiners, are offering this material as low as 3¾ cents with some going to brokers at 3⅝ cents. A like situation is apparent in the other grades of gasoline, but the quantity of the 375 endpoint gasoline and the 390 endpoint gasoline sold, is comparatively small. There is practically no material being purchased for export.

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REFINED MARKET BAROMETER

The uncertainty of the outcome of attempts to overthrow proration in the Mid-Continent, the widening of the dealers' discount along the Atlantic Coast, the posting of lower retail prices in California, and the slow movement of all commodities from the Gulf for export, have all tended to weaken the general price structure but few actual price changes have been posted by the larger refiners. Hope is based on the belief that increased business will soon result from early spring buying.

Atlantic Seaboard—During the past week the Standard Oil Co. of New Jersey increased the dealers' discount to 3 cents and following this, the Atlantic Refining Co. and the Continental Oil Co. reduced the gasoline tank car price to 7 cents. These changes have caused further price shading on small lots of gasoline and left the balance of the refined oil price structure heavy. Spring demands for motor oils, distillates and Diesel oils have increased sales and these offer some encouragement.

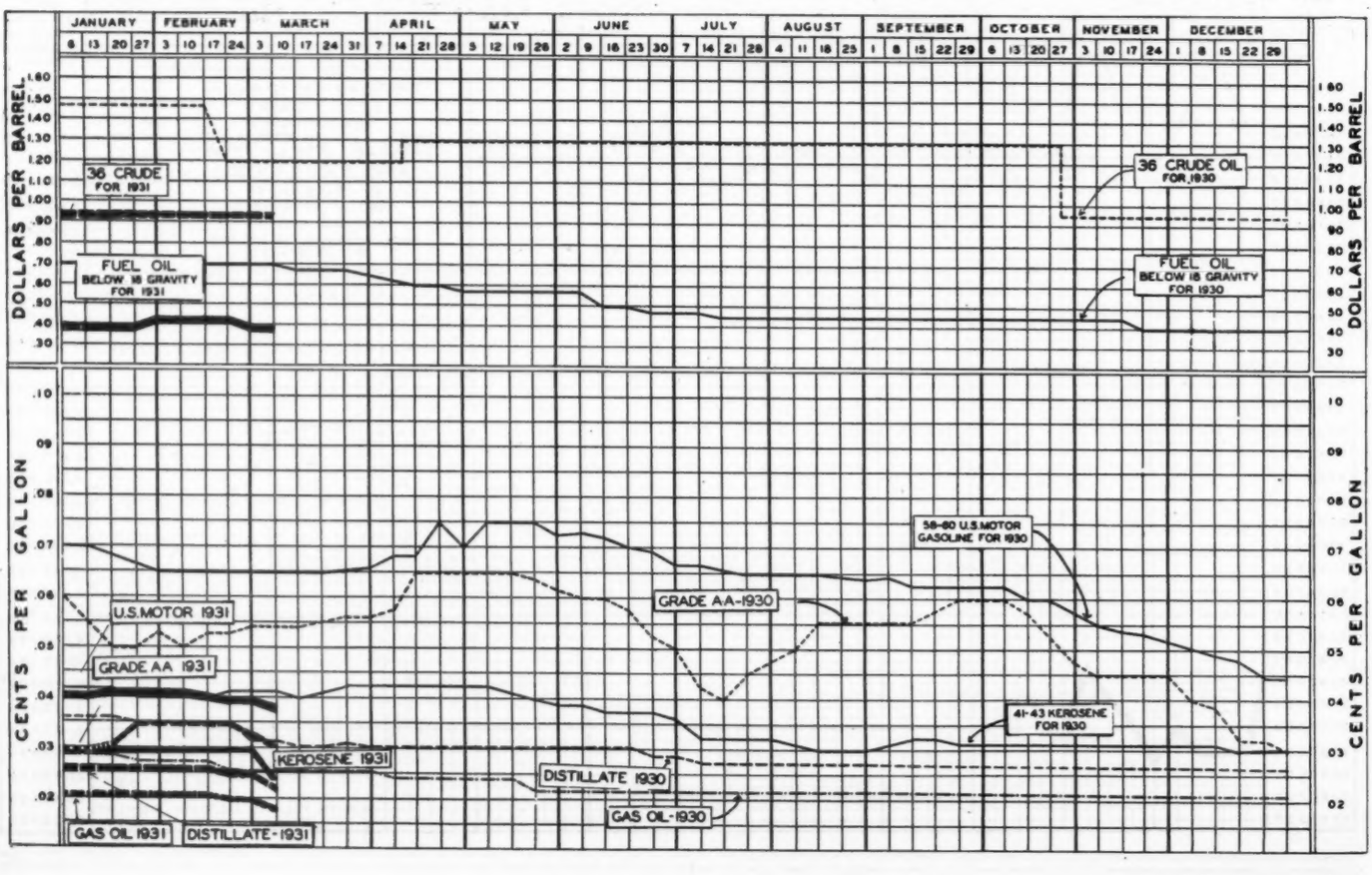
Mid-Continent—More distress gasoline appeared on the market and price shading caused a new low in the range of prices to be established. Natural gasoline prices acted in sympathy with the refinery gasoline market. Fuel oils and motor oils moved at a normal rate.

Chicago—Additional price concessions were offered on gasoline, kerosene and gas oil by the smaller refiners and jobbers were using this to force a general reduction. Fuel oil, distillates and motor oils continue to move at a fair rate.

California—Fuel oil prices were advanced in the California area while gasoline prices acted in the opposite direction as a result of unfavorable developments in the retail market.

Gulf Coast—Gasoline quotations were freely heard an eighth to a quarter cent below those of a week ago. Red oil and pale coastal oils were also being traded at slight price concessions. Fuel oil remained steady.

Pennsylvania—Gasoline, kerosene and wax prices were reduced slightly while motor oils held firmly at last week's price level.



A.P.I. Continues Fight for the Code

Board of Directors at Chicago Decides to Petition Federal Trade Commission to Set Aside Its Nullifying Order

By C. O. Willson

CHICAGO, Mar. 3.—The board of directors of the American Petroleum Institute, in session here today, voted to continue the fight for a national code of practices for marketing refined petroleum products. The industry, through a committee, will petition the Federal Trade Commission to set aside its order of January 30, which if finally made effective means that the oil industry cannot continue its present code with governmental approval. The order of the commission is now under suspension until April 8 and it is hoped that a workable code with the approval of the commission can be worked out by that time.

The directors ask that all those engaged in petroleum marketing continue to observe the rules of the code until the final action of the commission is made known.

The action of the board of directors was in line with the recommendation of the marketing division of the institute, which opened its first semiannual meeting at the Stevens Hotel Monday. Members of the division and a large number of executives of marketing companies discussed the code situation in business sessions held Monday morning and afternoon. Approximately 100 marketers were in attendance, including representatives of practically all the major companies. E. G. Seubert, vice president of the institute in charge of the marketing commission, presided at the meetings. Paul Hadlick, who is secretary of the marketing division and who has devoted most of his time to code work, presented a report.

As marketers, including officials of many state jobbing associations, gathered here on Monday and Tuesday, it became apparent that the great majority believe that the code of ethics in petroleum marketing should be continued if there is any feasible method of doing so. Many have expressed the opinion that the code application had just reached the point where it would be of real benefit to the industry.

The year and a half that it has been in force, due to conditions over which the marketing division has no control, has been a particularly trying period for those engaged in the distribution of petroleum products, and it is felt that the code has aided materially in preventing chaotic conditions which would have demoralized the entire industry. It is believed that the objectionable and impractical features have been eliminated and with a return to more normal conditions the constructive value of the code will be more generally recognized, both within and outside the industry.

Statement by Board

The board of directors in connection with its resolution to continue the code made the following general statement:

"The marketing code has been accepted by approximately 16,000 companies and individuals engaged in marketing petroleum products. It has been in effect and has been observed generally since August 31, 1929.

"The law imposes upon the Federal Trade Commission the duty of preventing unfair methods of competition, and not merely the duty of punishing unfair methods of competition. The code, as it stands, is a decided step forward in preventing unfair methods of competition. Attention is called to the following paragraph contained in the foreword to the commission's publication, dated July 1, 1929, 'Trade Practice Conferences':

"'The procedure is predicated on the theory that the primary interest of the Federal Trade Commission is the interest of the public. The public is entitled to the benefits which flow from competition, and each competitor is entitled to fair competition. The legitimate interests of business are in perfect harmony with the true interest of the public. That which injures one undoubtedly injures the other, and the commission, in the trade-practice conference procedure, provides a medium through which, in appropriate situations, the interests of both may be mutually protected in matters of competitive practices. It also offers, in the conferences, a common ground upon which competitors can meet, lay aside personal charges, jealousies, and misunderstandings, freely discuss practices of an unfair or harmful nature, or otherwise not in the public interest, reach a basis of mutual understanding and confidence, and provide for the abandonment of such practices.' (This exact language is repeated in the annual report of the commission for the year ended June 30, 1930.)

"It is our opinion that the code in all substantial respects is lawful and that its observance by the industry involves no violation of the antitrust laws and that those engaged in the marketing of petroleum products may carry on lawfully under this code. No change has been made in the law as it existed at the time the commission approved this code nor do we know of any decision of any court which would seem to render unlawful any practice sanctioned by any rule contained in this petroleum code.

"The Institute, with the knowledge of the Federal Trade Commission, has set up machinery for the purpose of acquainting all marketers with the code, with its proper interpretation, and with the action that may be legally taken to comply with its provisions. The administration of the code is conducted under the supervision of the general committee of the division of marketing, and by its many subcommittees, including eight regional committees and one or more committees in each state. There are now approximately 800 members of the various subcommittees. A great deal of time and study has been given to this problem and the machinery has been gradually strengthened and it is now functioning efficiently.

Reasons for Recommendations

"We believe our recommendations should be approved for the following reasons:

"(a) The tendency of the code and one of its purposes is to reduce the cost of distribution and the cost of petroleum products to the ultimate consumer.

"It is a well known fact that today it costs more to deliver gasoline from the refiner to the consumer than it costs to produce the gasoline at the refinery. This is caused in part by the unnecessary multiplicity of outlets. It is our information that there are today 2.7 gasoline pumps to every mile of highway in the United States. One of the purposes and effects of the code has been to discourage unnecessary and uneconomic duplication of gasoline pumps, the number of which is already far in excess of the reasonable requirements of the consumer.

"Attention to the need for economy was referred to in the first report of the Federal Oil Conservation Board made to the President on September 6, 1926, when the board said:

"'Co-operation within the industry can effect economies all along the line; in development and production, a better balancing of supply to demand, when and where the oil is needed; in transportation, better planning, thus avoiding cross-hauls of crude and cross-hauls of products; in distribution, less duplication of marketing facilities, which at times even involve an expense equal to the cost of production and refining. Large savings in both production and refining are possible through the general adoption of the best technique already used by the more progressive units.'

"(b) The code is designed to, and is having the effect of, preventing unfair competition—a thing denounced by the law.

"(c) The code is substituting open an honest competition for secret and unfair competition.

"(d) The code is preventing unfair price discrimination between consumers in the same class.

"(e) The code requires a lawful and

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Refiners to Discuss Future Motor Fuel

Interest Also Focused on Marketing Problems and Recent Action of Federal Trade Commission

Reaction of the Western Petroleum Refiners Association to the move of the Federal Trade Commission in withdrawing its approval of the code of ethics sponsored by the American Petroleum Institute, is expected to be clearly defined in the executive sessions during the first day of the association's annual meeting at Excelsior Springs, Mo., March 10, 11 and 12.

Many of the executives who will attend the March 10 sessions are now in Chicago where the marketing division of the American Petroleum Institute, and the interested departments, are convened to discuss future plans for the code of ethics. After the Federal Trade Commission had postponed until April 18 the action which officials of the American Petroleum Institute say will blot out an advance enjoyed by practically all marketers of refined oil products, the American Petroleum Institute moved its marketing sessions to Chicago for the dates March 3, 4 and 5, as an emergency measure.

The program of the Western Petroleum Refiners Association has been completed for all except the opening day, when the executive sessions are scheduled. This portion of the refiners' convention slate may not be announced until the position and the plans of the A.P.I. groups are available for discussion.

On March 11 and 12, sessions of the refiners' meeting will be devoted to papers presented by the manufacturing committee. L. R. Crawford, of Producers & Refiners Corp., president of the association, will be in charge of the technical sessions. The papers and the discussions which will follow each of them comprise material, according to officials of the association, for one of the best meetings ever held of interest to the manufacturer.

The topics range from the experiences of a well known refinery engineer in Soviet Russia, to the latest developments in systems for recovering refinery gas. Another paper advances octane numbers as the most suitable measuring stick for antiknock ratings, and presents a justification for the opinion that motor fuels of the future are to be made to meet the requirements of the high compression ratio motors.

Atmospheric and vacuum distillation are treated at length in another paper. The engineer's standpoint in the matter of lubricants, and processes in the manufacture of grease, are presented in the two remaining papers.

Chairmen presiding at each of the morning and afternoon sessions, March 12, are, respectively, C. L. Henderson, of Vickers Petroleum Co. and A. S. Hopkins, of Standard Oil Co. of Kansas.

WESTERN PETROLEUM REFINERS MEETING

Opening Session, Luncheon, 12 o'Clock, Wednesday, March 11

Chairman, L. R. Crawford, Producers & Refiners Corporation.

Paper, "New Natural Gasoline Specifications," S. S. Smith, Shell Petroleum Corporation.

Paper, "Manufacture of Grease," F. M. Simpson and C. C. Welsh, Empire Oil & Refining Company.

Paper, "Atmospheric and Vacuum Distillation on Mid-Continent Crudes," John Primrose, Foster Wheeler Corporation.

Morning Session, Thursday, March 12, 9:30 o'Clock

Chairman, C. L. Henderson, Vickers Petroleum Company.

Paper, "My Experiences in Russia," F. C. Koch, the Winkler-Koch Engineering Company.

Paper, "Recent Progress in Knock Testing," Earl Bartholomew, Ethyl Gasoline Corporation.

Afternoon Session, March 12, 1:30 o'Clock

Chairman, A. S. Hopkins, Standard Oil Company of Kansas.

Paper, "Lubricants, from the Automobile Engineers' Standpoint," H. C. Mougey, General Motors Corporation.

Paper, "New Developments in Refinery Gas Recovery Systems," A. W. Burket, Jackson Engineering Corporation.

Method of Repressuring Individual Wells

Production Program of Gulf Production Co. at Hankamer, Southern Liberty County, Presents Interesting Aspects

By Nell Williams

HOUSTON, Tex., Mar. 2.—A program seeking to conserve the natural resources and to increase producing efficiency is being carried on by the Gulf Production Co. at its Hankamer Field in southern Liberty County. So far the work has been more or less experimental as the nature of the field as revealed by development to date has not afforded opportunity for the inauguration of a permanent system of operation. However, what has been done has resulted in material reductions in gas-oil ratio, increases in production and maintenance of flowing life of wells.

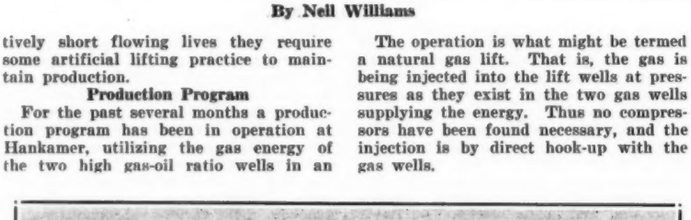
Unlike some of the other newer coastal fields in which general repressuring, or rather, pressure maintenance programs have been practiced successfully, Hankamer so far has not been deemed adaptable for such a project. Although all the wells within the present producing area were spaced and drilled with a view toward repressuring, the 11 wells completed represent what are believed to be seven distinctive producing horizons. Attempts to correlate the various sands have been unsuccessful and it is doubtful whether as many as three wells are producing from any one of the horizons.

Conditions in the field, however, have been such as to make desirable the installation of some form of flowing efficiency procedure. Two of the 11 wells completed have had relatively high pressures, and, producing only a negligible amount of oil, each has had an excessive gas-oil ratio amounting to approximately 700 feet per barrel. On the other hand, the remainder of the wells, which are in different and shallower sands, have had very little pressure, and after comparatively short flowing lives they require some artificial lifting practice to maintain production.

Production Program

For the past several months a production program has been in operation at Hankamer, utilizing the gas energy of the two high gas-oil ratio wells in an adaptation of the gas-lift principle to the field. Although so far it has not been considered practical to institute a general repressuring program, as repressuring usually is thought of, the Gulf Production Co. is successfully injecting the gas into individual wells.

The operation is what might be termed a natural gas lift. That is, the gas is being injected into the lift wells at pressures as they exist in the two gas wells supplying the energy. Thus no compressors have been found necessary, and the injection is by direct hook-up with the gas wells.



Hook-up of Gulf Production Co.'s No. 1 Boyt at Hankamer showing injection of gas through tubing.

An accompanying plat shows the hook-ups, of which there are two, each separate from the other. Three wells are being flowed by the lift, although it is possible that others can be added. In the first hook-up, gas from No. 7 Boyt is being injected directly into No. 1 Boyt, the discovery well of the field. The working pressure of No. 7 is 825 pounds, at approximately which pressure No. 1 is taking the gas. In the second hook-up, well No. 8 is flowing directly two wells, Nos. 5 and 6 Boyt, each in a different sand. No. 8 has a pressure of 900 pounds.

At presents wells Nos. 7 and 8 are operating without separators. In this both oil and gas production is being injected into the lift wells, Nos. 1, 5 and 6. No attempt has been made to separate the oil and gas in view of the fact that the oil production from these wells has been comparatively small.

Trial of Repressuring

Plans are now being made by the operators to attempt a trial in repressuring, and, with this in mind, separators are to be set up at Nos. 7 and 8, each to trap whatever oil there might be and provide a gas as nearly dry as possible for injection purposes. A separator having a capacity of 1,000 pounds pressure will be provided for each well. In addition, meters will be installed so that an accurate check of volumes can be made.

For the proposed repressuring project the shallowest sand at 2,600-2,900 feet has been selected as the most logical. Three wells apparently are producing from this horizon and these happen to be in one group. No. 2 Boyt (see accompanying plat) has been chosen tentatively as the key well. This well has been producing around 75 bbls. of oil daily. It is anticipated that the sand in this well will take gas at natural pressures and that no compressors will be needed.

However, in the operation of the lift system, whereby gas is being injected into the individual wells, very favorable results have been attained. Chief among these has been the conservation of gas in the two wells, Nos. 7 and 8, each of which formerly had an abnormally high gas-oil ratio of approximately 700 feet per barrel of oil. Utilization of this excess energy as a lifting agent for oil in

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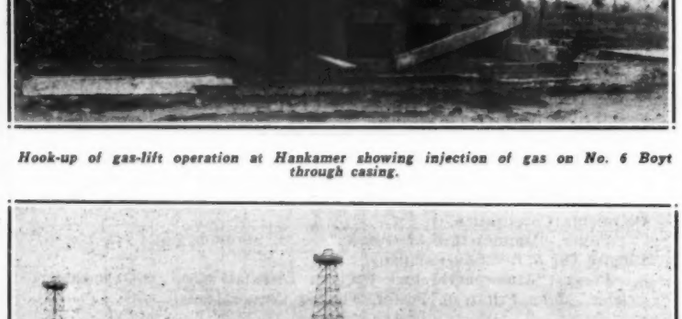
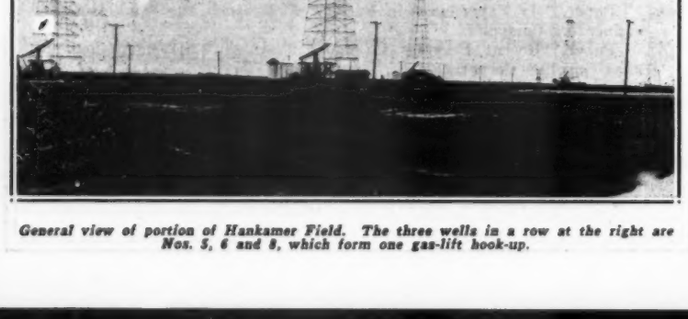
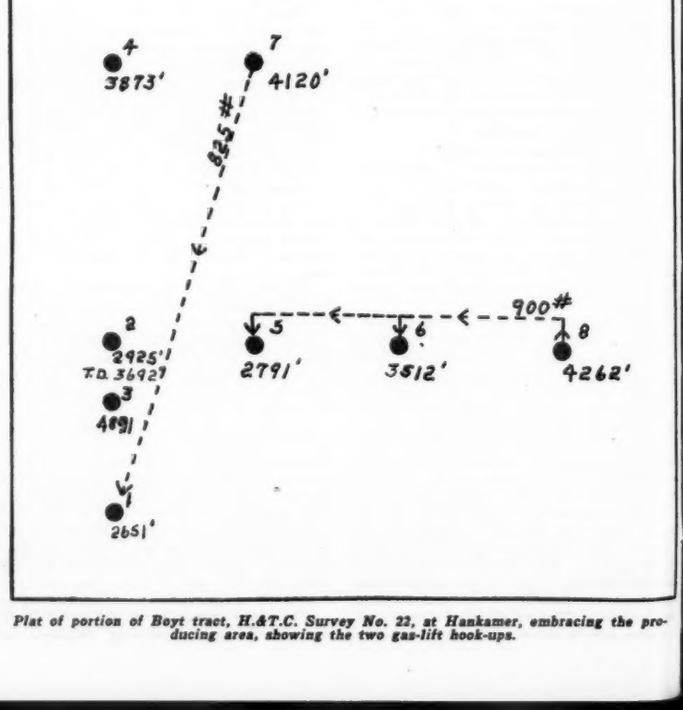


Hook-up of gas-lift operation at Hankamer showing injection of gas on No. 6 Boyt through casing.



General view of portion of Hankamer Field. The three wells in a row at the right are Nos. 5, 6 and 8, which form one gas-lift hook-up.



Plat of portion of Boyt tract, H.&T.C. Survey No. 22, at Hankamer, embracing the producing area, showing the two gas-lift hook-ups.

Governors Tackle Crude Oil Situation

Appeal to President Hoover and Big Companies for Conference on Oil Imports. Proration Meetings in Oklahoma

With oil state governors meeting in Fort Worth, Tex., to help in the greatly involved overproduction situation; legislative committee meetings in Oklahoma City to listen to arguments for and against any extraction of teeth from the Oklahoma conservation law of 1915; Corporation Commission meetings to listen to the pros and cons on the question of increasing the allowable production of the Oklahoma City Field; Governor Murray's plan for state-paid umpires in Oklahoma, and meetings of owners of stripper wells in Oklahoma in an effort to find customers for their oil, the past week was one of great activity among oil men and governmental agencies.

After 13 hours of parleying at the Texas Hotel, Fort Worth, Tex., on the evening of February 28, and March 1, William H. Murray, governor of Oklahoma; Ross Sterling, governor of Texas; Alfred Landon, representing Gov. Harry Woodring of Kansas, and Dr. E. H. Wells, representing Gov. Arthur Seligman of New Mexico, announced the final agreement in regard to proration of the various oil-producing states represented at the meeting:

"It is agreed by, between and among William H. Murray, governor of Oklahoma; Ross Sterling, governor of the State of Texas, and representatives of the governors of the States of Kansas and New Mexico, assembled at Fort Worth, Tex., for the purpose of discussing conservation of crude petroleum and natural gas, and bring about concerted action on the part of all oil-producing states, to conserve the natural resources of such states:

"That the governor of each state here represented shall immediately appoint a representative on a committee to be styled the Oil States Advisory Committee;

"That the other oil-producing states be invited and requested to take similar action, and to join with these states in the conservation program;

"That such organization so formed shall immediately take such action as may be necessary to recommend and sponsor such necessary legislation for all oil-producing states as may be necessary effectually to conserve to these states their natural resources, for the benefit of the public and posterity, such legislation to be as nearly uniform as practicable.

(Signed) "WILLIAM H. MURRAY,
"Governor of Oklahoma.
"ROSS STERLING,
"Governor of Texas.
"ALFRED LANDON,
"Representing Gov. Harry Woodring of Kansas.
"DR. E. H. WELLS,
"Representing Gov. Arthur Seligman of New Mexico."

Telegrams to Executives

The following telegram was sent to President Hoover of the United States and to the president of the Gulf Oil Corp., Sinclair Consolidated Oil Corp., Cities Service, Standard Oil Co. of Indiana, Standard Oil Co. of New Jersey and Royal Dutch-Shell Oil Corp.:

"We, the governors of Oklahoma and Texas, and representatives of the governors from Kansas and New Mexico, in conference here Saturday to work out stabilization plans for the oil industry, urge you to call a conference of the major companies importing crude oil and its refined products to meet with the Oil Conservation Board and the Federal Trade Commission for the purpose of limiting their imports. We are dealing with a grave emergency in the oil situation now existing and appeal to you as President to urge an immediate agreement by these importers with the sanction of the various federal authorities."

Governor Murray of Oklahoma issued the call to the governors of the neighboring oil-producing states which culminated in the meeting at Fort Worth at 7:30 p.m. February 28, lasting until past midnight. The members again convened at 9 a.m. Sunday to continue the discussion of the oil industry's sad dilemma, finally completing its initial task at 4:30 Sunday afternoon.

Governor Murray's first proposal to relieve overproduction of oil in the United States is by the method of barring those companies which engage in the importation of crude oil and refined products into the United State from foreign countries from operating in Oklahoma, Texas and neighboring states. This plan was laid before Governor Sterling of Texas and the representatives of the governors of the States of Kansas and New Mexico, who took it under advisement Saturday night.

R. R. Penn, chairman of the Central Proration Committee of Texas, was appointed by Governor Sterling to act as representative of Texas on the Oil States Advisory Committee, and Cicero Murray, cousin of Governor Murray, was appointed to act for that official on the committee. Gov. Harry Woodring of Kansas will probably appoint Alfred Landon as his representative, and the governor of New Mexico is expected to appoint Dr. E. H. Wells as his representative on the committee, which will have a tremendous task before it when it starts to function.

Favors State-Paid Umpires

Plans to continue oil proration under a system of state-paid umpires supported by a special tax on oil, displacing the present system wherein proration umpires are supported by the oil companies, were announced Monday by Governor Murray of Oklahoma in stating he was adopting a proposal suggested to him by Paul A. Walker, chairman of the Corporation Commission.

An additional gross production tax on oil and gas of one-twentieth of 1 per cent would be levied for the exclusive purpose of administering the proration system the money derived from this tax to pay for umpires and assistants and also that part of the expenses of the Corporation Commission arising as a result of oil regulation.

A Texas Feature

This feature of the Murray plan is copied from the Texas law.

Murray also wants oil field umpires appointed or approved by the governor. Appointments now are made by the Corporation Commission.

Murray's plan will be discussed in detail in a special message to the legislature now in process of preparation but his statement Monday was accepted as tantamount to an announcement he intends to continue the proration policy but would strengthen the system to eliminate criticisms growing out of administration of the laws by persons not actually in the pay of the State and charged on this account with playing favorites as between different oil companies and different producing fields.

Advisory Committees

Advisory committee of operators should be selected in each of the fields, the governor said, such committees to suggest suitable persons for umpires and also to advise with umpires on matters of administration after appointments are made. In both instances, however, the committees would function only in an advisory capacity and would be without power and serve without pay, the idea simply being to give the various interests representation and an opportunity to present their views.

Hearing on Jones Bill

The oil and gas committee of the Oklahoma House of Representatives did not meet on Monday, March 2, because so many of those who would have taken part in the session were engaged in some other meeting. The committee was in session on two days in the past week listening to testimony for and against the Cham Jones bill which would amend the Oklahoma conservation law of 1915 by interpreting waste as only actual waste and not economic waste.

After hearing testimony of proponents of the Cham Jones bill including Pat Malloy, special counsel for the Sinclair Oil & Gas Co.; and former Congressman E. B. Howard, the oil and gas committee of the House of Representatives listened to the testimony of a number of Oklahoma oil producers and executives of oil companies who were opposed to the passage of the Jones measure. James C. Denton, vice president of the Mid-Continent Petroleum Corp., said his company was running 25,000 bbls. a day from wells in Oklahoma to its Tulsa refinery. Of this the company purchases 15,000 bbls. and runs 10,000 bbls. of its own production. His company, Mr. Denton said, could supply its needs from its own wells but being in favor of the proration of production in the State it keeps a large part of its own production shut in. If proration is ended in the State his company would be compelled to protect its own properties from drainage by taking all its crude requirements from its own wells, thus making it necessary to withdraw as a buyer of oil at many wells to which it is now connected. Mr. Denton characterized Harry F. Sinclair, H. H. Champlin and W. R. Ramsey, leading in the campaign against the existing proration plan, as smart business men. Sinclair's company, he said, had sold all its stored oil and was seeking a new supply at low prices; Champlin, he said, has a refinery and a pipe line and a lease in the Oklahoma City Field consisting of one-third of an acre from which, according to the witness he had already produced 30,000 bbls. per day in a field where the average oil recovery is estimated at about 20,000 bbls. per acre. Denton's testimony sought to show that Champlin was not only drawing on his own one-third acre but on the sand underlying neighboring town lots. Speaking of Ramsey, Denton said he had sold out his Oklahoma City leases for part cash and part from the proceeds of oil produced.

Denton said Oklahoma's natural market for oil was 225,000 bbls. per day, that being the volume of oil run to stills in Oklahoma. Beyond that the producers in the State must sell to outside buyers and in doing this Oklahoma oil comes into competition with oil produced in other states, principally with Texas oil, which can be drilled for at much lower prices than in the deep new fields of Oklahoma and where there is an undeniably big potential production.

Mr. Denton emphasized the need of curtailment in the face of the fact that possible production is four or five times greater than crude oil demand. Proration is the best remedy he could think of, he said, and he believed he voiced the sentiment of 98 per cent of the oil producers in the State when he came out against the Jones bill.

Other witnesses, all of whom gave testimony against the Jones bill and in favor of a continuance of crude oil production curtailment and a continuance of proration, were Wirt Franklin, one of the largest operators in the Oklahoma City Field; F. W. Merrick of Ardmore, a producer in the southern end of the State; W. E. Wood of the Kingwood Oil Co., Okmulgee, and president of the Independent Oil Men's Association, who said he represented 125 producers in the Okmulgee district; J. I. Cromwell, producer in the Oklahoma City Field; E. B. Lawson, chairman of the distress oil committee in the old northeastern fields of the State; J. B. Steele, of the Kewanee Oil & Gas Co.; H. B. Fell of Ardmore, president of the Southern Oklahoma Oil & Gas Association; and J. Wood Glass of Nowata, representing more than 350 owners of old stripper wells in the Nowata-Chelsea district.

Wirt Franklin made a fiery witness. Franklin was one of the discoverers of the Healdton Pool, which was developed at about the same time as the Cushing Field, and he was one of the first oil conservationists in the State and in large part responsible for the passage of the Oklahoma oil conservation act of 1915

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Governor R. S. Sterling of Texas (left) and Governor William H. Murray of Oklahoma, in Fort Worth, Tex., February 28 and March 1, attending the meeting of the chief executives of Oklahoma, Texas, Kansas and New Mexico, which was called by Governor Murray to discuss proration in these and other oil-producing states.

How Valves Met New Drilling Demands

Experience at Oklahoma City Field Has Shown Manufacturers Kept Abreast of the Times. Product for Each Emergency

By A. V. Wadsworth

The Oklahoma City Field is recognized by many as having presented, in actuality, more problems, each pressing for solution, than any other single field of more recent discovery. True, California offered like problems but the Oklahoma City Field was drilled comparatively fast and the high pressures and great volumes were of necessity handled promptly and effectively. The fact that here was a well gone wild and others giving into the sand for a repetition, served to keep us all thinking fast and endeavoring to cope with a serious situation.

With the rapid development of these fields many problems unexpectedly presented themselves for immediate solution. Deeper wells and higher pressures placed new demands on the drilling operator, who, quite naturally, turned to the manufacturer for equipment that would enable him to efficiently meet the increasing demands of the field. It was this rapid development of large fields, and the constant demand for new and improved equipment that turned the manufacturing engineers into a new field—they began to supply the industry with equipment of improved quality. What the industry would soon demand became an anticipated item in the manufacturers' plans. In fact, conditions in the field were causing a general upheaval in the method of manufacturing operating equipment.

Among all the manufacturers of oil and gas well drilling equipment no one industry was better equipped to take care of the needs of the field than were the drilling and flow line gate valve manufacturers. As pressures were gradually increased, valves had to be made stronger. The old method of "piling on weight" to give added strength was no longer considered. The need for steel alloy valves became fully recognized. Various steel alloys—containing nickel, chromium, manganese and high proportions of carbon—were used to greatly increase the strength of valves, and yet not add to their weight.

Valve manufacturers gave close attention to methods of melting, kept accurate check on analysis, watched closely the reaction of these new alloy steel valves as they were tested under pressures unheard of in earlier practice. To increase the efficiency of their product manufacturers began using the X-ray to examine the valves. This advanced method gave them a knowledge of castings construction that aided materially in improving the safety and operating qualities of the valves.

Revolution in Construction

Here was a revolution in valve construction. The demands of the field were being met by a product of greater strength, greater safety—yet of the same weight as the valves that served former pressures.

It is true that some few valves, but in percentage extremely few, were sand blasted to destruction. However, in no case was any valve burst except where valves were in no way intended for the service for which they were used. In fact, every valve manufacturer was amazed at the uses to which his product was put, in frequent instances.

Instances of the use of gate valves for 125 pounds oil, water and gas for 250 pounds of steam, 250 pounds oil, water and gas for 300 pounds and 350 pounds steam superheated, were not uncommon occurrences. Instances where iron valves made for 800 pounds oil, water and gas pressures were hooked into steel valves of 2,500 pounds working pressure and the actual pressures on the lines standing above 2,000 pounds were found. This condition was not particularly existant in Oklahoma City to the exclusion of the other fields. One manufacturer cites a claim made for free replacement of a valve on which the bonnet broke under pressure of the line. Investigation disclosed it to be in a line carrying 1,200 pounds pressure, equipped with 800-pound oil, water and gas valves. The valve which had broken was for 400 pounds oil, water and gas pressure.

Manufacturers had long before tested up to 10,000-pound and 15,000-pound gate valves designed for working pressure of 2,500 pounds and less. Therefore, in all of this history of Oklahoma City not one of the flow line and drilling gate valves, except the few sand blasted out, failed under pressure. The manufacturers had no intention of fooling themselves, much less any user of their product, so destruction tests had been the rule. X-ray examinations had definitely pointed the way to overcome slag segregations, shrinkage cracks, and porous spots and these extreme tests had proved the soundness of the reasoning and practice. Sound steel castings of 80,000-pound tensile with 110,000-pound ultimate strength were procurable and with these finer, better alloys properly mixed and poured, and liberal factors of safety allowed, the results were practically certain.

Blasting Effects

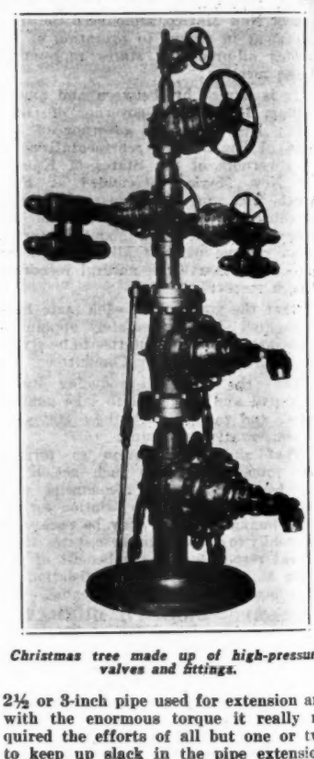
We have touched upon the blasting effects of the sand carried up by the gas flow of these wells. When one compares the possibilities of destruction to average castings in the cleaning rooms of our steel and iron foundries where sand for cleaning the castings is carried through nozzles at air pressures of 80 to 100 pounds per square inch and makes comparison with even a coarser and harder sand carried at velocities induced by 20 to 25 times that pressure, we begin to appreciate that the seats, discs and bodies of our drilling and flow line gates, as used in this field, must be composed of alloys of extreme hardness. Probably not to exceed one-fourth of 1 per cent of all the thousands of gate valves used in this field were seriously cut out, notwithstanding the terrific destructive sand blasting to which they were exposed.

Great improvements due to exhaustive research had developed tool steels of sufficient hardness and toughness to cut this tough, hard alloy of which the valves were made and grinding process made possible their economical production.

Stems, for the most part, were of stainless steel, heat treated and of great tensile strength. When frozen, which was the case in many instances due to violent pressure drops, as many as 18 men with tongs forced these gates and the total number of twisted stems was negligible—less than one-tenth of 1 per cent for the entire field. The fact that valve stems were damaged in so few instances is the best evidence that no unusual force or at least a force not unexpected by the designers and manufacturers, was applied.

Occasional cases of seeming carelessness or oversight were checked by manufacturers. One reported a case where a lower drilling gate was opened about one-third while the upper one was opened full. Naturally this sand blasted the disc in the lower valve, practically destroying it. Valves on these high pressures should be of proper sizes that all should be wide open when flowing. Any restricted valves will, of necessity, be cut out regardless of the materials of which they are composed.

It may have appeared to the layman that a force ranging from 2 to 12 or 14 men was extremely dangerous or impractical, but in the majority of cases these gates were closed at considerable distance from the head. With 40 to 150 feet of 2½ or 3-inch pipe used for extension and with the enormous torque it really required the efforts of all but one or two to keep up slack in the pipe extension.



Christmas tree made up of high-pressure valves and fittings.

In design it was early decided that long slow tapering throats between seat diameters and pipe threads obviated interference with direct flow. As a consequence, where the discs were pulled wide open the flow was direct and very little sand cutting took effect due to these gradual tapers.

Exceptional Toughness and Hardness

In the years just previous, the introduction of extreme high steam pressures and high temperature gas oil cracking units called for the production of gate valves of exceptional hardness and toughness. This developed alloys for seats and trim generally, and body and bonnet alloys to withstand great expansions and consequent contractions yet safely carry dangerous loads. The industry was well prepared to meet the emergency.

Naturally, the alloys differed some. Metallurgists differed in the detail, some using more nickel or chromium, others favoring manganese, and of course carbon proportions differed slightly in keeping

(Continued on Page 191)

ASSOCIATION MEETINGS A FEATURE OF LOS ANGELES' BIG OIL SHOW

By L. P. Stockman

LOS ANGELES, Calif., Feb. 28.—Besides the meetings of the various technical societies, the newly formed Independent Association of California has also arranged for a meeting to be held during the second annual Oil Equipment and Engineering Exposition. The program for this is now being prepared and the details are being handled by W. E. Dunlap, executive director, and Robert L. Smith, assistant director. It will be held on the evening of March 19 in the meeting room off the main building at the exposition.

Due to the widespread interest being shown in the export meeting which will be held at the exposition on March 16, speakers familiar with the foreign oil situation have been asked to furnish information relative to operating conditions in various countries. Among these are V. M. Korobovkin, technical director of the Amtorg Trading Corp. at New York City, and W. Cole, foreign representative for Byron-Jackson Co. in Los Angeles. All manufacturers of oil equipment who are interested in export trade have expressed their intention of attending this meeting, and, although a 80'x40' room has been provided, the present indications are that it will be taxed to its capacity. W. R. Martin of Martin-Decker Corp. will act as chairman. T. Sutter, Baker Oil Tools, Inc.; L. C. Harbert, J. P. Ratigan; B. A. Cleveland, Regan Forge & Engineering Co., and C. Homer Spotts, McEverlast, Inc., have arranged the program.

Installing Large Exhibits

Many pieces of larger equipment which require extensive foundation work have already been installed in the main building. Among these are a complete hydraulic drilling rig, two complete motor-driven pumping units and several model pieces of equipment which will all be in operation. The decorations for the booths are being put up by many of the companies in order to get away from the last-minute rush which generally attends the opening of an exposition. The second annual Oil Equipment and Engineering Exposition is fortunate in that nearly 100 exhibits were previously installed as a part of the permanent exposition. Several of the companies are, of course, adding elaborate decorations for the big show which will be held from March 16 to 22, 1931.

Several new developments in equipment for the drilling, production, transportation and refining branches of the industry will be introduced for the first time at the second annual exposition. Work on these is being rushed so that they will be ready for presentation at the opening of the show. Several are of the larger type and will be displayed on the outside space.

Requests for the special rate railroad certificates, which will be issued to members of the societies which hold meetings in Los Angeles during the exposition are now being received. All such members from outside of the city should send their applications in at the earliest possible moment. The societies whose meetings make them eligible for this special rate are the American Institute of Mining and Metallurgical Engineers, the American Petroleum Institute, American Welding Society, California Natural Gasoline Association and the Southern California Meter Association.

Admission to the second annual exposition will be free to everyone connected with the oil industry. Tickets are being supplied through the various magazines and by all of the exhibitors and requests for them have been received from points as far east as Ohio. In order to keep an accurate record of all visitors, tickets must be presented when entering the grounds. The free admission to oil men enables them to inspect every exhibit thoroughly and to visit the exposition as frequently as is convenient and desired.

Crude Outlet Situation in East Texas

Feverish Activity in Construction of Pipe Lines. Railroads Energetic in Competition for Oil Business

By L. E. Bredberg
Fort Worth Bureau, The Oil and Gas Journal

HENDERSON, Tex., Feb. 28.—Seven lines, four of them 4-inch and three of them 6-inch lines, are now running oil from the Joiner Field, Rusk County, to loading racks at Friar Switch on the branch line of the I. & G. N. Railroad, 6 miles northwest of Henderson, and two more are under construction with others rumored to run from this field to racks at Friar Switch, while still others, five in number, are either contemplated or surveys are being made at the present time. These five lines will run to Overton, Arp and Tyler to the west, and will serve refineries which will be constructed at those places, and will also carry Joiner crude to loading racks from which it will be shipped to Houston and other points. Arp and Overton are on the main line of the I. & G. N. Railroad, but Tyler is 24 miles west of the field, and is on the Cotton Belt Railroad.

Beacon Oil & Refining Co.'s 2,500-bbl. skimming plant being erected along the I. & G. N. Railroad, 2 miles north of Henderson, Tex., in the East Central Texas area.

Most of the short lines serving the loading racks from which Joiner crude is shipped, are owned by independent operators or producers, and small companies. The Sinclair-Texas Pipe Line Co. is the largest company having a line into the pool, and late rumors are being broadcast that this company is to lay 265 miles of line to connect with Oklahoma lines, carrying Rusk County crude into Oklahoma and other refineries. This rumor has not been authenticated, consequently it is only considered as a possibility, although the company is expected to lay a main trunk line from this area to the Sinclair Refining Co.'s 60,000-bbl. refinery at Houston.

Difficult to Prorate

The producing areas of East Central Texas are considerably different from the Panhandle, Ranger, Wichita Falls and West Texas districts in that these new areas are cut up into many small tracts, largely owned by independent operators, and the major pipe line companies have not obtained a strong foothold on this district.

Two small pipe line companies serving the Joiner Field were the first to post a price on crude from that field, 40 cents per barrel, and one major pipe line company has recently shut down construction on a carrier which was going to the Bateman Field in northern Rusk County. There is only one company now serving the field with a gathering line and loading rack on the main line of the I. & G. N. Railroad 3 miles west of the town of Kilgore. This is the Houston Oil Co.'s gathering line and rack. The company is shipping crude to its refinery at Camden, Ark. Authentic reports state the company would also lay a line, probably a 6 or 8-inch to Amigo Switch on the Cotton Belt, approximately 11 miles west, and will build a loading rack at that switch to ship out from that point as well as over the I. & G. N. Railroad which is now carrying tremendous loads of supplies and oil.

Rumors were heard that the I. & G. N. Railroad might declare an embargo on oil, and ship out only a small amount daily, but officials of the company stated they would increase facilities, and would take thousands of barrels per day for shipment.

Railroad Lowers Rates

The Texas & Pacific Railroad which runs through Gregg County, approximately 3 miles south of the Farrell-Lathrop discovery well, has already lowered its freight rates on oil from Willow Springs to Shreveport to 7 cents per hundredweight. The Arkansas Fuel Oil Co., part owner in the well, and holder of approximately 3,000 acres of leases around it, was contemplating the laying of an 8-inch line from the well direct to Shreveport, but the lowering of the rates will no doubt check the laying of this line at least for some time.

An 8-inch line is ready to be laid 24 miles from the Joiner Field to Tyler on the Cotton Belt, to serve two refineries at Tyler, besides possibly supplying loading racks, thereby giving the Cotton Belt Railroad a considerable amount of business. And it is not improbable this railroad may help subsidize some small pipe line company, or a group of individuals in laying a line from the Joiner Field to the Cotton Belt.

Many have been of the opinion that crude contracts could easily be obtained for Joiner crude, and that the price of oil would soon fall as low as 25 cents, but this does not look probable at present, for many are seeking such contracts, while others have recently closed contracts for several millions of barrels, and the price of this crude has been held steady, actually rising a little. This development came about because eight of the wells in the field had gone dead, due it was generally believed to lack of gas and oil, but after they had been cleaned out, swabbed in a few instances, screens or perforated liner had been removed and tubing run, they came back on production, looking about as good as before. The Woodbine sand, from which East Central Texas production comes, will no doubt maintain its past records and prove prolific in this field as well as the Kilgore and the Farrell-Lathrop Field, and these wells may not go on the pump for months. There are only two on the pump at present, and they are near the discovery well on the extreme eastern edge.

With More Gas

Wells in the western, southwestern and northwestern parts are coming in with more gas, and are much larger wells than those completed on the eastern side, and no one can tell how much farther in these three directions the pool will run, or how large or small the other tests drilling will gauge, but it is generally believed the wells to the west will all be good sized wells whether there is much gas with them. Many tests are now drilling west of the western extension wells of Lide and others on the Young farm in the Prue Survey and the Haynes Brothers Drilling Co.'s well to the north, one of the tests, Guy Lewis' No. 1 Cooke in the J. Jordan Survey being about 3 miles west of production, and over in Smith County, and it will not be long before everyone will know just how far the Joiner Field will run. Several tests are drilling to the north towards the Kilgore Field, and these will either prove or condemn the possibilities of linking the two producing areas now separated by only about 8 miles of unproven acreage. Last week the Kilgore area was extended one-half mile south and 1 mile northeast, and the Joiner Field has been receiving short extensions every week, George S. Anderson's No. 1 Frederick in the Ximenes Survey making about a mile extension northeast 10 days ago when it came in for an initial production of 10,000 bbls. Several other extensions are due to be proven this week in the Joiner, Kilgore and Farrell-Lathrop Pools. The Kilgore Field may be extended another 3½ miles by the Brandon and McCamey test, 1 mile northeast of the town of Kilgore, but at present no definite information can be given as to its producing possibilities. It is down to a crucial depth.

Kilgore, Tex., showing the main street, railroad station, cars on siding, and large crowd which is continuously milling around the street and stores. This town is located 3½ miles northeast of the Bateman discovery well on the Crim farm, in the Sevier Survey, northwestern Rusk County.

One major pipe line company, the Magnolia Pipe Line Co. is laying a line into the Kilgore and Farrell-Lathrop areas, and the Gulf Pipe Line Co. has surveyed for a lateral line into the Kilgore area. Other reports that the Shell Pipe Line Co. may lay a line into the Farrel-Lathrop area have been given out. The Humble Pipe Line Co. has not yet resumed construction on its 8-inch into the Kilgore Field from its Van-Louisiana line but at present it reaches within about 3 miles from the Humble Oil & Refining Co.'s producing wells and block, two wells on that block now producing, and having no pipe line outlet. Work on this line will probably be resumed immediately. A pumping station will be constructed at the point where work on the line was stopped.

Other pipe lines are rumored for the areas, and these will no doubt be constructed. The laying of short lines in these areas does not entail much expense. Many of them are laid on top of the ground, and small pumps are used in the fields to pump the oil the short distance to the loading rack. A slush pump is used on one of the 6-inch lines serving the Joiner Field to pump crude through that line from the field to a loading rack on the I.&G.N. railroad, and other similar pumps are used on other lines to force the oil through them to the various loading racks.

The United Gas Co. is doing much speedy construction work in Gregg and Rusk Counties since the tremendous growth of the towns in the vicinity of the pools. A 6-inch welded line is being run from the 8-inch main line to Kilgore and the Bateman Field, and several companies are using gas in this field and the Joiner Field for drilling purposes. This necessitated the laying of smaller lateral lines to serve the fields and the wells.

Crew arc-welding Sinclair-Texas Pipe Line Co.'s 6-inch line from the Joiner Field to a 40-car loading rack at Friar Switch. The N. A. Saigh Contracting Co. of San Antonio, Tex., laid this line, and the A. F. Day Construction Co. did the electric welding.

Universal Oil Drops Important Suit

Effect Agreement With Gulf Refining Co. in Settlement of Cracking Patent Infringement Case. Atlantic Also Protected

The Gulf Refining Co. and the Atlantic Refining Co. have each signed an agreement with the Universal Oil Products Co. in full settlement of all pyrolytic cracking patent litigation now pending and protection is given to all parties in regard to any future application of such patents. The sum paid to the Universal is said to exceed $2,000,000 in each case and marks another step in the direction toward the dissolution of the mass of cracking patent litigation pending.

The Universal, owners of the Dubbs process, instituted a suit against the Gulf Refining Co. as a result of the operation of a deFlorez unit at the latter's plant at Girard Point near Philadelphia, Pa. It was contended in the claims that the operation of the deFlorez unit involved the infringement of certain patents held by Universal. The deFlorez unit had been developed by Louis deFlorez and others and the patent rights were later secured by The Texas Company.

The Gulf Refining Co. controlled certain patents issued to Alexander & Bacon. So The Texas Company and the Gulf Refining Co. entered into an agreement whereby an exchange in the use of these patents was provided for. As a result, both the Gulf Refining Co. and The Texas Company built a number of cracking units incorporating features covered by all of these patents.

Early in January it was learned that controlling interest in the Universal Oil Products Co. was purchased by the Standard Oil Co. of California and the Shell Union Oil Co. and immediately following this purchase it was also announced that an agreement had been signed by representatives of the Standard Oil Co. of New Jersey, Standard Oil Co. of Indiana, Standard Development Co., The Texas Corporation and the Gasoline Products Co. terminating all existing litigation and provided for future mutual protection against one another.

The Texas Company, being one of the signers of this agreement, was thus relieved of a suit involving the use of the deFlorez cracking unit, and the Gulf Refining Co. remained to act in the defense of the Universal's suit against the use of the deFlorez unit. As a result of the agreement the Gulf also withdraws its counter suit.

The Atlantic Refining Co. has not been sued by the Universal Oil Products Co. but is now installing several deFlorez units at its Philadelphia plant which accounts for the interest the Atlantic has in effecting an agreement with Universal.

In the agreements signed by the three parties it was also specified that licensees of the respective processes would receive a like protection and this in turn will have a broad effect in mitigating cracking patent litigation. In the case of the Gulf Refining Co. it was specifically agreed, however, that Gulf will retain all patent rights included in what is generally known as the McAfee process, which covers the use of aluminum chloride for the cracking of heavier hydrocarbons.

Thus within the past two months, the problem of settling many of the costly suits among the various large refining companies has been settled and the Dubbs process has been brought under the direct control of major refining units within the industry. The effect of these agreements will be far reaching and will no doubt stimulate the building of additional cracking units. The need for increased cracking capacity has been emphasized by the increasing need for gasoline of still higher antiknock value. The cracking process has been the principal means of raising the antiknock value of the base fuel up to the standard now being demanded and as the standard is further raised the demands for cracking may be expected to be correspondingly increased.

DEUTSCHE SINCLAIR EXPANDS

NEW YORK, Mar. 2.—Deutsche Sinclair Petroleum G.m.b.H., with headquarters at Cologne, has increased its capital from 500,000 to 1,500,000 marks. The German Sinclair subsidiary, which was organized early last year, has already established an extensive distributing system in western Germany. The company operates a bulk and blending plant at Duisburg, on the Rhine.

UNION ADDS STABILIZER

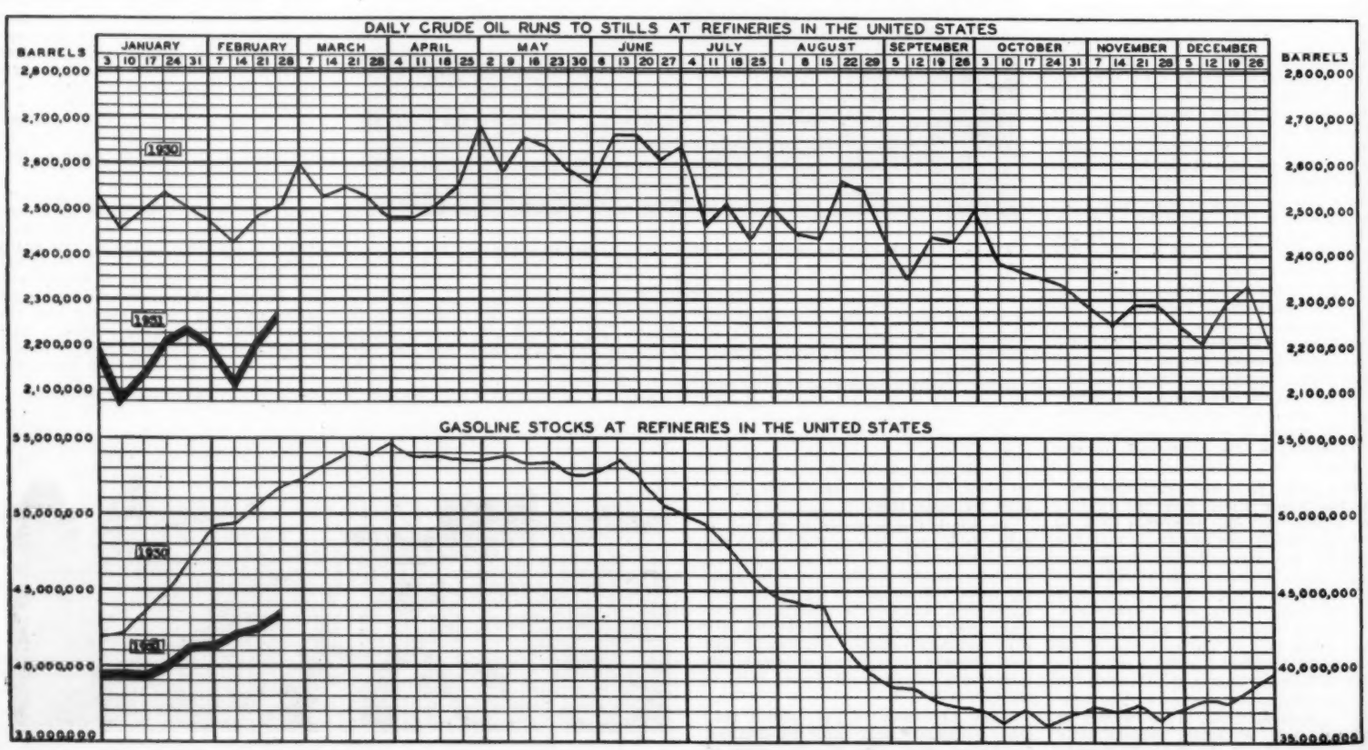
The Union Oil Co. is building a 5,000-bbl. stabilizing unit at its Wilmington, Calif., refinery. The new unit is expected to be completed within the next 30 days.

AMERICAN PETROLEUM INSTITUTE WEEKLY REFINERY STATISTICS

The weekly report made to the American Petroleum Institute on refinery statistics—crude runs to still, gasoline stocks and gas and fuel oil stocks in barrels—for the week ending February 28.

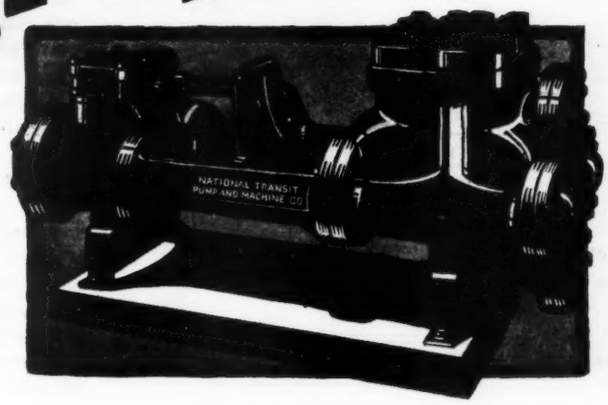
	Week ending February 28				Week ending February 21				Week ending February 28, 1930			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
East Coast	100.0	440,000	7,939,000	7,300,000	100.0	450,700	7,745,000	7,331,000	100.0	3,412,500	8,433,000	6,391,000
Appalachian	93.8	96,300	1,480,000	1,096,000	93.8	91,600	1,408,000	1,063,000	91.0	580,500	1,679,000	677,000
Indiana, Illinois, Kentucky	97.5	289,600	5,140,000	3,026,000	97.5	272,600	4,983,000	3,054,000	98.6	2,127,500	7,804,000	3,000,000
Oklahoma, Kansas, Missouri	89.4	247,700	3,245,000	3,757,000	89.4	251,700	3,119,000	3,735,000	89.1	1,898,400	4,698,000	3,222,000
Texas	91.9	546,400	7,290,000	9,421,000	91.9	535,800	7,004,000	9,313,000	90.7	4,232,600	8,097,000	12,006,000
Louisiana and Arkansas	98.3	144,000	1,801,000	2,337,000	98.3	137,300	1,722,000	2,295,000	96.8	1,300,400	2,686,000	2,092,000
Rocky Mountain	93.1	37,400	1,851,000	893,000	93.1	47,700	1,816,000	971,000	93.6	337,100	2,925,000	1,042,000
California	98.8	464,700	16,046,000	101,315,000	98.8	483,000	15,811,000	101,310,000	99.3	4,261,500	15,868,000	109,781,000
Total United States	95.7	2,266,100	44,792,000	129,145,000	95.7	2,270,400	43,608,000	129,072,000	95.5	18,200,500	52,190,000	138,211,000
Texas Gulf Coast	100.0	433,600	6,030,000	7,057,000	100.0	399,400	5,739,000	6,938,000	100.0	3,265,700	6,990,000	9,365,000
Louisiana Gulf Coast	100.0	98,700	1,591,000	1,266,000	100.0	91,300	1,526,000	1,262,000	100.0	817,800	2,353,000	1,261,000

(1) Per cent of refinery capacity represented. (2) Daily crude runs to stills. (3) Gasoline stocks. (4) Gas and fuel oil stocks.



Data for 1930 based on weekly reports of the American Petroleum Institute. Data for 1929 derived from monthly reports of the Bureau of Mines, Department of Commerce. Figures for last week not shown in graph but are included in above tables.

Living up to a Lithograph



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This Annual Refinery Number of The Oil and Gas Journal records the fact that even in abnormal times the refining division has pressed forward in making the oil business a real manufacturing industry in contrast to the somewhat amateur, rule of thumb operations of earlier days.

If the oil business is to become a real manufacturing industry there will be no question about its stabilization because industrial history shows that those industries which are based on scientific and highly technical operations are the most stable. They rest on the inherent value extracted from the raw material by manufacturing processes.

In the past the manufacturing end of the oil industry was regarded as a secondary or inferior phase of the entire business. The big idea then was to secure the maximum production of the raw material. Manufacturing, indeed, in those days consisted merely of a rough separation through distillation of the crude oil in which the principal products were obtained. Scientific control, as we have it today, was generally lacking.

Today less than half of our gasoline comes from that source and our least desirable motor fuel is obtained from that operation.

For a time our development centered on securing larger yields of the necessary products. At the present time thought and effort is concentrated on securing quality, rather than quantity, with an ever-present incentive to reduce cost to the lowest possible point due to competitive conditions.

The fact that a gasoline has properties which will cause it to vaporize for use as a motor fuel—based on volatility—is no longer sufficient. With the inducement offered by the motor car manufacturers the refining industry is going more and more into other properties of motor fuel.

Of recent years the antiknock property in motor fuel has become of special importance. The knock rating is bringing out revolutionary ideas in regard to what are the desirable properties in a gasoline.

Each of the components has a definite influence on antiknock value and the refining industry is now perfecting methods by which it can increase or control these properties in gasoline to attain the desired antiknock rating.

A few years ago the common compression ratio was 4.5:1 in car motors. One motor manufacturer has at the present time 65 test cars in the field, some with compression ratios of 8:1, studying these problems.

The industry is confused by having several gasolines which will operate present cars but just as soon as arrangements can be completed for general distribution of this type of higher compression car with the required quality of fuel there will be even greater emphasis on the importance of refinery processing.

In fact, the oil industry's future welfare and stability will depend upon encouragement to motor manufacturers in this development.

If the industry had never made anything but straightrun gasoline it would utterly have failed to supply the demand and the price would have been far above what it has been. Refining efficiency has improved the quality and cheapened the price. This ability to better the product and lower the cost is the characteristic of a permanent industry as distinct from the haphazard enterprise marked by deteriorated products and increasing prices.

As the refining industry improves quality by increased efficiency it will be enabled to broaden its markets. Charles F. Kettering said recently that if the oil industry could supply the fuel many industries served by steam engines and electricity could be converted into oil consumers, with a consequent demand far greater than any at the present time.

Despite the bad year, the oil business had a fairly satisfactory increase in gasoline consumption in 1930 and a relatively small decrease for other products. This is reflected in the annual survey which shows at the present time, not including plants under construction, there are more active refineries than ever before. This is only part of the story. The same report shows that 207 of these refineries have cracking units with a total capacity of 2,000,000 barrels a day. The refining industry has expended as much as in any other year in expanding its plants and manufacturing processes.

The advances made in the manufacture of motor fuel through the application of scientific research has been duplicated in the manufacture of lubricants.

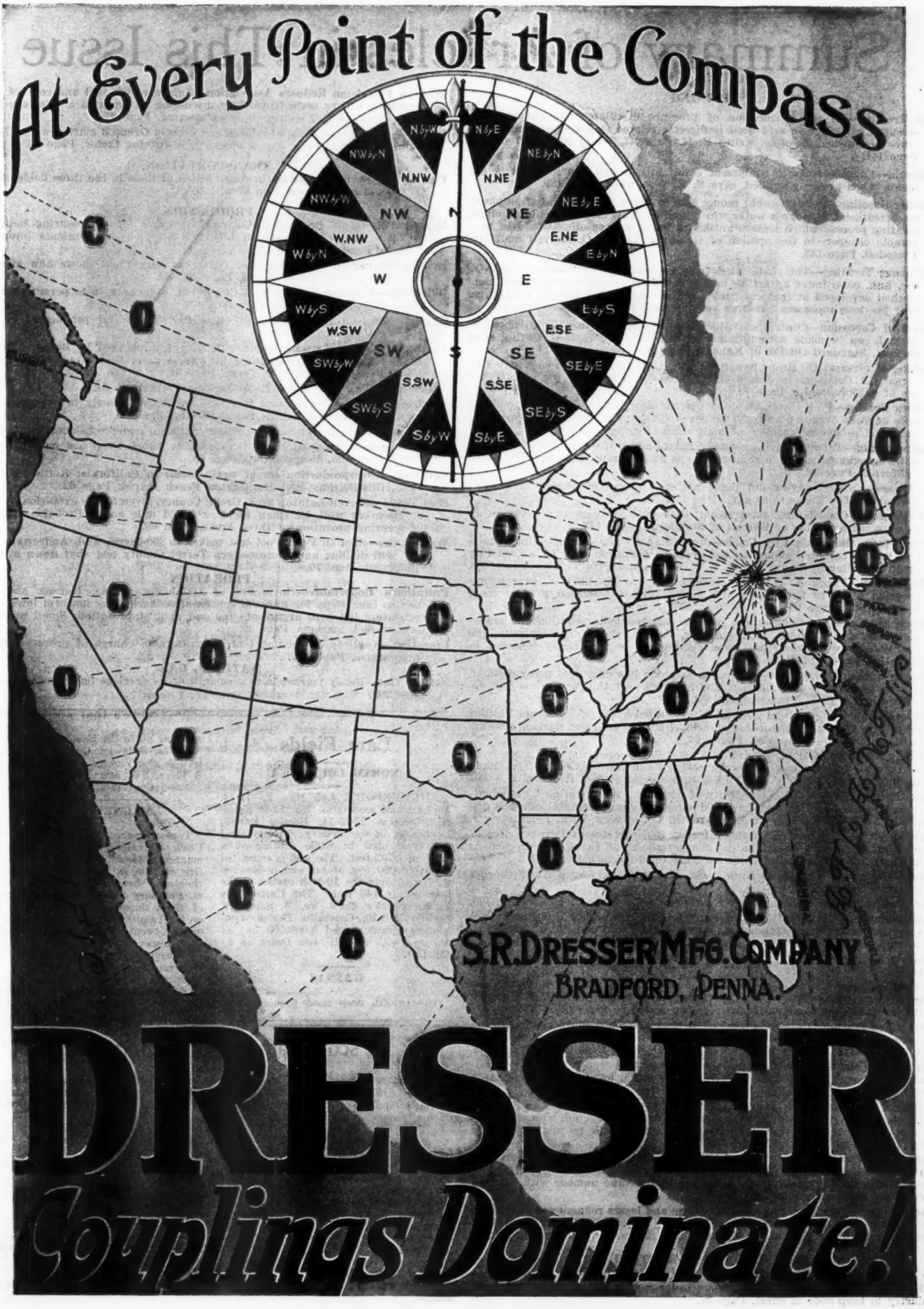
Similar progress has been made in the manufacture of products for use in the paint, solvent, cleaning, drug and other industries and specialty markets can be further extended.

What the steel industry has accomplished in the application of science to its operations is being duplicated by the refining industry. It was not until the chemical composition of steel was studied that we were able to produce steel of the quality necessary for the mammoth structures and tremendous stresses of today. It may be added that it was the discoveries made by the steel laboratories which influenced the study of the effects of carbon and sulphur in the refining industry.

Quality produced by highly scientific and technical skill will create a demand that will so stabilize the industry that its markets cannot be upset by an Oklahoma City field or any other field because the demand will depend upon the manufacture of the finished product, not upon the quantity of raw material produced.

This is illustrated in the steel industry where iron ore is stabilized by the market for the manufactured products. The most highly efficient manufacturers control the automobile situation by their superiority in skill and ability and technical progress.

Production of superior products through intensive manufacturing processes, at the same time lowering costs, will prevent the competition of substitutes which can be found only at greater expense. The hydrogenation process will further strengthen the oil industry's position in this regard.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Sulphur and Color—Presence of sulphur in Signal Hill crudes has marked catalytic action on the production of color. Operation of plant is described by O. C. Smith, superintendent, Western Oil & Refining Co. Page 136.

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West Texas—Shot in Penn Pool test makes it 350-barrel well. Andrews County test still drilling and southwestern Terrel County test shut down awaiting equipment. Page 70.

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Proration's Importance—Governors of Oklahoma, Texas, Kansas and New Mexico take steps for uniform conservation backed by uniform laws, while legislators listen to arguments for and against proration. Small producers meet to seek markets. Page 39.

Proration—Analysis of personnel of committees in charge of proration in the three states. Page 197.

NATURAL GAS

Natural Gas—Ready market in new eastern areas develops large gas production. Page 200.

Late Fields

NORTH LOUISIANA

SHREVEPORT, La., Mar. 2.—H. I. Morgan and associates' No. 13-B Kendrick, Section 22-19-11, Bossier Parish, Louisiana, in the Bellevue Trinity sand gas area, blew in while drilling at a depth of 1,702 feet. The well is estimated at 40,000,000 feet of gas and is blowing wild with only the 10-inch casing in the hole set at 147 feet. The United Gas Public Service Co.'s No. 3 Saunders, Section 42-8-10, Concordia Parish, Louisiana, wildcat, tested 3,000,000 feet of dry gas with a drill stem tester at 1,438 feet.

KANSAS

The twelfth deep sand producer was showing oil in the Eastborough Pool near Wichita, Sedgwick County, Kansas. The well is the Vickers Petroleum Co.'s No. 3 Keys, SW cor. NW NE Section 31.

(Continued on Page 199)

MAGNETIC STORMS

Tucson observatory of the United States Coast and Geodetic Survey report two magnetic storms for this past week, the first starting at 11 p. m. central standard time on February 23 and ending at 9 p. m. February 24. The second storm was of short duration starting at 11 a. m. on the twenty-fifth and ending at 2 a. m on the twenty-sixth. The telegrams are as follows:

"Storm began twenty-fourth. Five. Moderate."

"Storm ended twenty-fifth. Three."

"Moderate storm began twenty-fifth. Seventeen. Ended twenty-sixth. Eight."

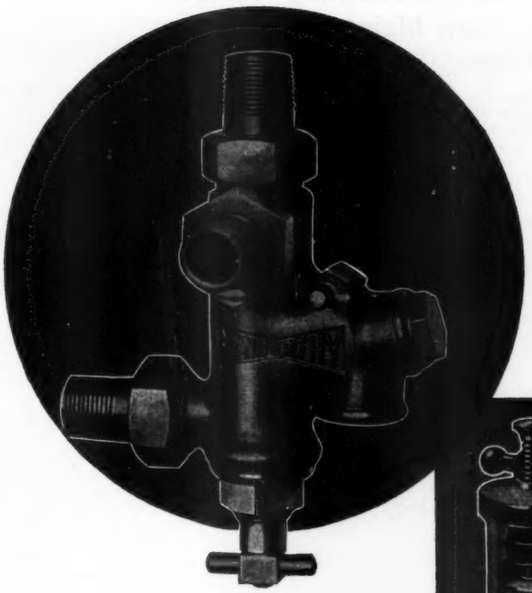
SCORE SHEET ON OIL PRODUCTION

Below is shown allotted average daily production in the United States from October 1, 1930, to April 1, 1931, suggested by the American Petroleum Institute's special committee on the economic situation, and the actual daily average production during the week ending February 28:

	Allotted (bbls.)	Actual (bbls.)	Over (bbls.)	Under (bbls.)
Okla., Kans., S. W. Tex., N. Tex.*	953,700	854,411	.....	99,289
West Texas and S. E. New Mexico	316,300	284,135	.....	32,165
North Louisiana-Arkansas	86,400	92,870	6,470	.....
Gulf Coast	177,800	178,114	314	.....
Rocky Mountain	58,600	59,831	1,231	.....
California	530,100	524,500	.....	5,600
Other fields	110,600	109,250	.....	1,350
Total	2,233,500	2,103,111	8,015	138,404

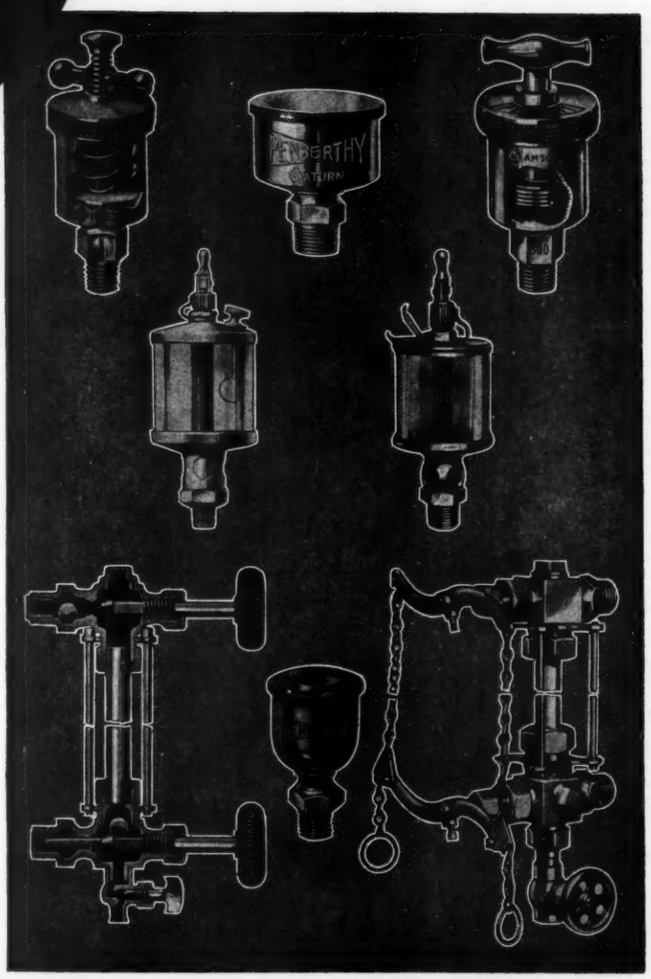
Net average daily underproduction 130,389 bbls.

*North Texas includes North, Central and East Central Texas and Texas Panhandle.



ECONOMY SUGGESTS

PENBERTHY PRODUCTS



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Internally Fired Stills Are Practical

Four Unit Shell Battery at Western Refinery Has Capacity of 12,000 Bbls. Daily. Low Maintenance Costs

By C. O. Willson

Four internally fired shell stills operated continuously as a crude oil battery at the Wilmington, Calif., refinery of the Western Oil & Refining Co. have given uniform satisfaction for the past four years and apparently are assured continued service for an indefinite period in the future.

The battery which has no duplicate among refineries in the United States, was adapted to California refinery requirements after units incorporating the internal firing principle had been successfully used at foreign refineries. R. R. Rakestraw, vice president of the Western company, spent several years in foreign service for Standard companies and during this period, built and operated a refinery in Rumania which used the internally fired shell still in the distillation of crude oil.

The four-still battery at the Western's Wilmington refinery was completed a little over four years ago and has been in continuous service since that time handling all crude oil skimming for the plant. The battery has a capacity of 12,000 bbls. daily taking approximately 45 per cent overhead and has operated at 80 to 95 per cent capacity since it was completed. So far as the stills, proper, are concerned, this capacity with larger dutch ovens could be increased to 15,000 or 18,000 bbls. daily without overloading the battery.

The design of the stills with the internal firing tube is simple. Each still is 13.5'x42' with a nominal capacity of 1,000 bbls. The firing tubes are 48"x43'. These tubes are five-eighths inch corrugated steel. As shown in the photograph and sketch each still has two of these tubes extending the entire length of the still. The tubes are located in the bottom half of the stills and are parallel to the bottom.

At the ends, the firing tubes are flanged and riveted to the ends of the stills which are of five-eighths inch gauge steel. The stills are set on cast iron supports and brick walls.

A dutch oven is located in front of each still. The firing chambers of these ovens are 7.5'x10'. The back of each oven is connected directly to the firing tube of a still by a steel tube.

The connecting tubes which are lined with fire brick are 5 feet long.

Method of Operation

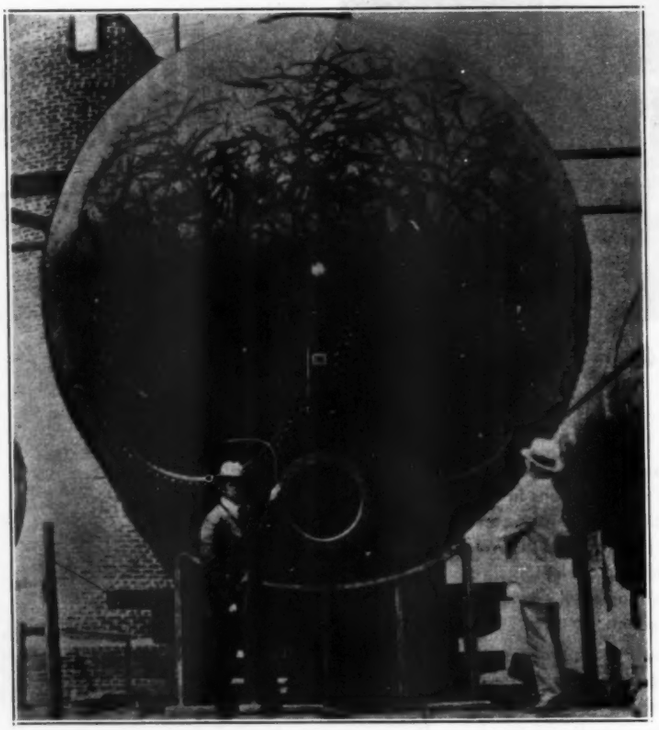
In operation, the dutch ovens are fired with either fuel oil or gas. The hot gases from the combustion chamber pass through the connecting tube to the front of a still where they are split between the two firing tubes. By means of a buck baffle in the rear of the stills, the gases from the firing tubes are kept from combining again and are passed along the sides of the still. At the front of the still the gases are again combined and pass finally along the bottom of the still. The heat efficiency of this operation is shown in the fact that the stack temperature of the gases does not exceed 700° F.

In operation all the stills are three-fourths full of oil which is sufficient to cover the firing tubes.

The heat efficiency in this method of operating shell stills is obviously much greater than the usual practice of firing direct from a furnace located beneath the stills, the convential design ever since the petroleum refining industry was founded. The surface exposure while not as great as in the case of modern tube still is sufficient to assure a heat exchange which gets away from the large losses usually associated with shell still operation. Operating with fuel oil the fuel cost in operating the battery is 1.25 per cent.

Aside from the greater heat efficiency, there are important savings in maintenance with long runs between shut downs. The maintenance on the four stills for the four-year period has been practically nothing. The design of the stills and the method of firing does away with all local overheating which results in leaks and regular replacement of bottom.

Due to this maintenance situation the battery is operated several months continuously between shut downs. A recent shut down after six months operation showed practically no coke in the bottom of the stills. The small accumulation in the bottom of the stills was mainly due to the extraneous material injected in the stills with the crude oil.



View of internally fired stills while being installed. Still rests on cast iron supports.

Heat Exchange Arrangement

The low fuel cost is partially accounted for by the heat exchange between the incoming crude oil charge and hot vapors and residuum from the battery before the charge reaches the stills. This heat exchange enables the operators to secure 50 per cent of the gasoline cut from an evaporator before the crude is charged to the stills.

The crude oil from storage as shown in the accompanying flow chart first passes in series through partial condensers located at the top of the evaporator and the four towers. This preheats the charge and also serves as a reflux in the control of the overhead streams.

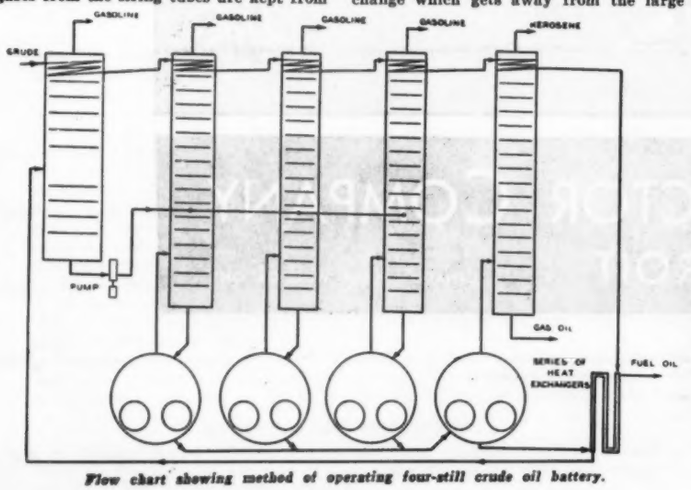
From the partial condenser of the fourth tower, the crude oil passes through five exchangers of the closed type where it is further preheated by the hot fuel oil residuum from the fourth still of the battery. The oil as it leaves the last heat exchanger, has a temperature of from 395° to 410° F. It is discharged into an evaporator. This evaporator is 7'x35'5". The lower half of the evaporator has six baffle plates over which the oil is discharged. The upper part of the evaporator has six bubble plates which furnish sufficient fractionation to permit 15 per cent of the crude charge being taken from the top of the evaporator as a high gravity gasoline stream. This stream, when the battery is being operated with the average crude oil obtained from Los Angeles Basin fields, constitutes about 50 per cent of the total gasoline yield.

A hot oil pump takes suction at the base of the evaporator, a constant liquid level being maintained by an automatic pump control. The hot oil charge is split between the towers of the first three stills. The towers are 6'x44' with 16 bubble trays each. The oil enters the towers at the sixth tray.

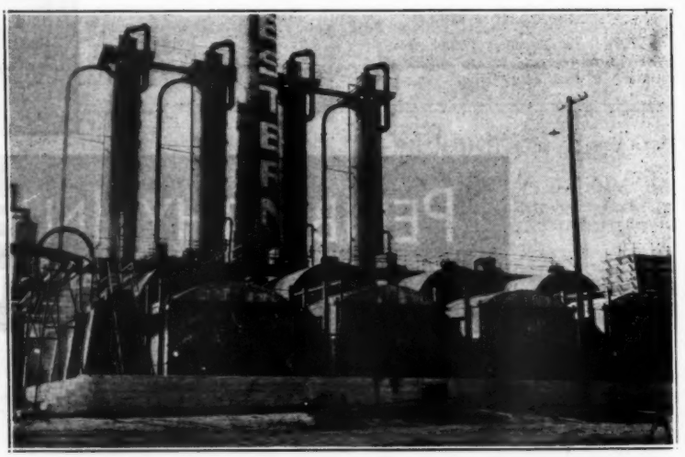
The reflux from each still, in a gravity flow, leaves the base of each tower entering the stills through a 6-inch line as shown in diagram. The oil is discharged near the center and top of the stills. A temperature of 550° F. is maintained in the stills which is sufficient to drive off all the remaining gasoline fractions in the crude oil.

The gasoline vapors from the towers pass to closed type water condensers. The gasoline streams are kept separate as they pass through the tail house to stor-

(Continued on Page 191)



Flow chart showing method of operating four-still crude oil battery.



Four-still crude oil battery using internally fired shell stills in operation for four years at Western's Wilmington, Calif., refinery. Dutch ovens shown in foreground.

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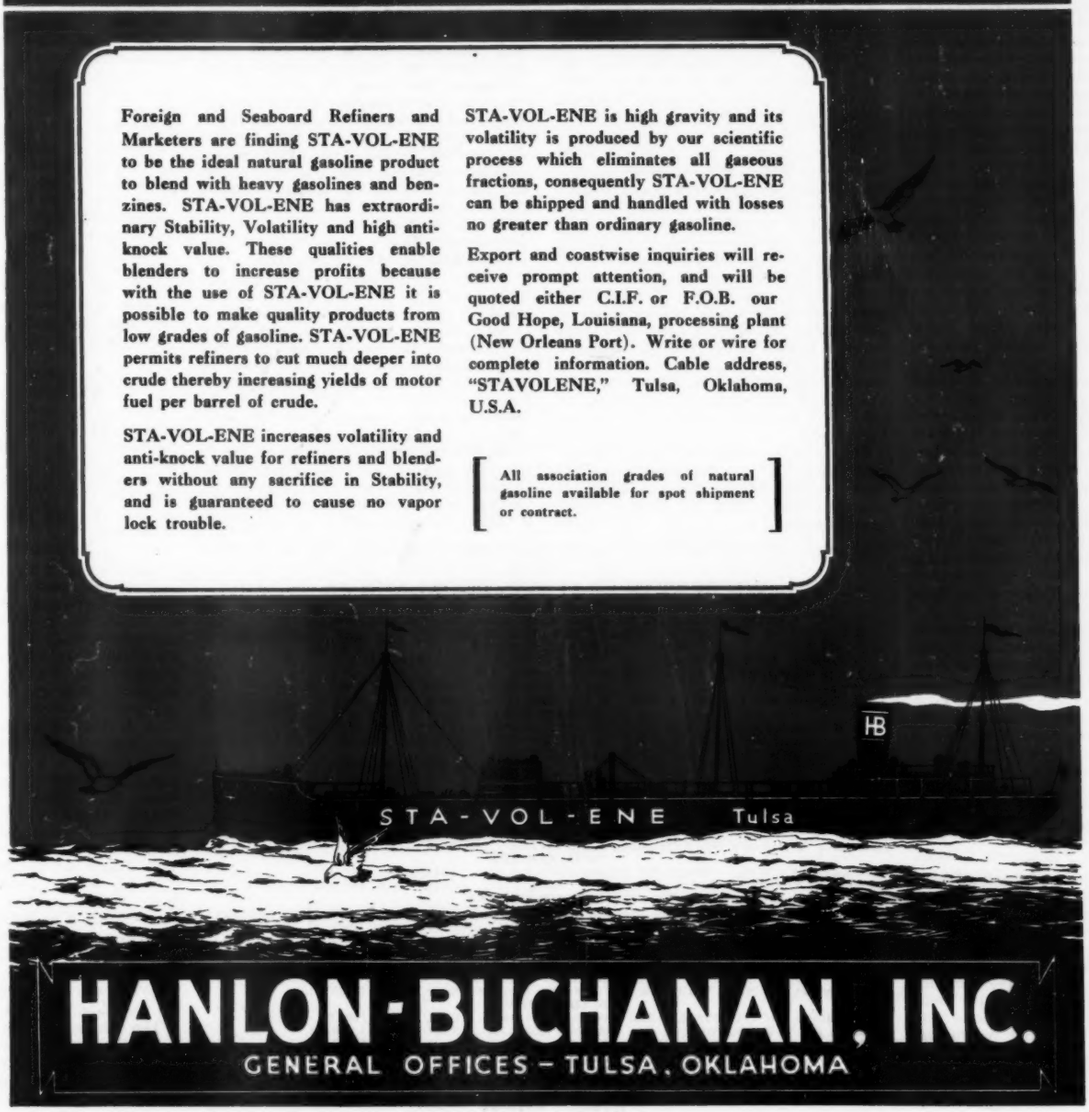

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GENERAL OFFICES – TULSA, OKLAHOMA

Big Drop in Oklahoma City Production

Wells Shut in to Permit Excess Oil to Be Moved From Tanks. New Proration Potentials Ordered by Umpire

By W. A. Spinney
Staff Correspondent, Oklahoma Fields

During the week ending February 28, a decline of 57,000 bbls. per day occurred in the daily average production of Oklahoma. Much of the decline is from the Oklahoma City Field which was quiet during the seven days as the majority of the wells were even with production and were shut in. The pipe line companies were attempting to remove some of the oil in storage on the leases and the operators were limiting the daily production.

The Oklahoma Corporation Commission ordered open flow potentials from all wells in the Greater Seminole area for a 10-day period from March 5 to March 15. The daily average production taken from the leases during these tests in the various pools will be considered the potential production for the month of April. Potentials for the month of March will be determined in accordance with the instructions mentioned in Umpire Ray M. Collins' letter of February 24.

Umpire Collins' instructions to the producing and pipe line companies to conform with the Corporation Commission's order, were that all wells in the following pools will be allowed to flow to full capacity for a 10-day period beginning March 5 and ending March 15: Allen (shallow and Wilcox), Old Earlsboro, Earlsboro Townsite, Maud, Seminole, East Seminole, Searight and St. Louis.

Wells in the following pools will be allowed to flow to full capacity for a 10-day period beginning March 15 and ending March 25: East Earlsboro, Sasakwa, Bowlegs, Mission, Little River, East Little River, and the settled production in the Carr City Pool, namely the Barnsdall Oil Co.'s Coker and Tully leases, Carter Oil Co.'s Nos. 1 and 2 Coker, Empire Oil & Refining Co.'s Cluck, Gypsy Oil Co.'s Coker, Magnolia Petroleum Co.'s fee, Prairie Oil & Gas Co.'s Billington, and the Sinclair Oil & Gas Co.'s Bean and Harjo leases.

During the 21 days in the month of March when the pools shown above are not open pipe line and purchasing companies are requested not to take over 25 per cent of the potentials except in East Earlsboro where the amount to be taken should not exceed 20 per cent of the potential.

The pools not mentioned in the above order are, South Earlsboro, Konawa, Wanette, and Townsite, and these pools will continue to be prorated without any changes, until further notice.

Proration Rules

State Umpire Collins advised all producing and pipe line companies, February 24, the following rules will be in force during the month of March. Leases in Class A pools and the small leases with potentials under 50 bbls. a day in other pools will be prorated the same as in January and February; 1½ per cent will be deducted from the February potentials to constitute March potentials. The purchasing and pipe line companies are requested to deduct differences, if the actual accumulated runs from any lease exceeded the allowed figure at 7 a. m., March 1, from the March runs. Lists were mailed from the office of the state umpire March 1, showing the potentials and the March allowed production. If shortages existed March 1, they were cancelled with the exception of the ones incurred by delay of having a new pipe line connection. Leases that have been granted temporary exemption will remain exempt for the month of March or until otherwise notified.

March potentials will be determined by deducting 3 per cent from the February potentials for the following pools: Allen (shallow and Wilcox) with the exceptions of Sinclair Oil & Gas Co.'s Cully A lease, Blackwell Oil & Gas Co.'s Fleet lease, and The Texas Company's Lewis lease from which 5 per cent will be deducted, and The Texas Company's Dinah lease from which a 10 per cent deduction will be made. Three per cent will be deducted from Bowlegs, Old Earlsboro, Little River, Lovell-Marshall, Maud, Mission, Searight, Seminole, East Seminole, St. Louis, and the settled production in the Carr City Pool, namely the Barnsdall Oil Co.'s Coker and Tully leases, the Carter Oil Co.'s Nos. 1 and 2 Coker, Empire Oil & Refining Co.'s Cluck, Gypsy Oil Co.'s No. 1 Coker, Magnolia Petroleum Co.'s fee, Prairie Oil & Gas Co.'s Billington, and Sinclair Oil & Gas Co.'s Bean and Harjo leases. Five per cent will be deducted from the February potentials for the following: Earlsboro Townsite, East Little River, Sasakwa, West Asher-Wanette and Konawa Pools.

Class A wells in the East and South Earlsboro Pools was allowed to flow to full capacity on March 2 and B wells on March 3 The total production from the Class A and B wells on these dates will be the potentials for the month.

The West Seminole Pool and the flush wells in the Carr City Pool was allowed to flow capacity on March 2. Production from the leases in these pools on on this day will be their potential for the month. Leases in the Wewoka townsite will take a three-hour open flow gauge from 7 a.m. to 10 a.m. March 2. The amount of oil produced, multiplied by eight, will be considered the daily potential production.

New potentials will be determined for such leases where the production has fallen off so they cannot produce their allowed amount. The last 10 days' average production in February will be the potential for March and will apply without exception to the leases in all of the pools under proration which show excessive shortage. This is in accordance with paragraph No. 5 of the order of the Oklahoma Corporation Commission. Where open flow gauges are required for potentials the offset operators are requested to witness the gauges.

Fire in Wewoka Field

During the week another fire was raging in the Wewoka Townsite Field in Seminole County. The well was Deep Rock Oil & Refining Co.'s No. 3 Douglass (50A), SE cor. NW Section 30-8-8, which caught fire February 24 and defied the crew of fire fighters for three days It was shot out by the Kinley brothers February 27 with 140 quarts of gelatin. The well was estimated to be making from 75,000,000 to 100,000,000 feet of gas a day and several attempts were made to shut the master gates before the well was shot out but all failed. The gas caught fire when a separator exploded and the flames shot 200 feet into the air and also set fire to an oil well 25 yards away which was flowing by heads. When the well stopped flowing the fire died out at the oil well. The burning well was located about a mile from the city limits of Wewoka, a city of 10,000 people, and is about 300 feet from the Wild Abe well which was also on fire a few months ago.

Oklahoma City Production

During the last part of the month the daily production in the Oklahoma City Field has shown a steady decline which it is believed is due to the majority of the companies in the field getting even with the allowable flow. Some of the pipe line companies have increased their shipments from the field due to the increased demands, and are taking oil from field storage.

An increase in the capacity of one of the pipe lines is about to start. Continental Oil Co.'s 8-inch line may be increased from 12,000 bbls. to 30,000 bbls. a day. The company is preparing to start construction work on a pump station which will increase the capacity of the line. The pipe line from the Oklahoma City Field meets the main line near Tonkawa. The line which is approximately 80 miles long is being operated with one pump station.

Good Well in Tatums Pool

Another large producer was added to the Tatums Pool and others are nearing the pay horizon. C. L. Anderson and others' No. 8 Eaves, SE cor. NW SW Section 24-1s-3w, in the south side of the field, swabbed 490 bbls. of oil the first 24 hours. The oil sand was found at 2,370-2,500 feet and the total depth was 2,854 feet. The average initial production of the eight producing wells on the lease was 970 bbls. a day.

Magnolia Petroleum Co.'s No. 4 Dickerson, SE cor NE Section 24-1s-3w, on the east side of the pool, was drilling out cement and preparing to complete. The casing was cemented at 1,915 feet on top of the oil sand, which was penetrated to 1,931 feet. If a commercial well is found at the location it will result in several other new operations on the east.

Carter Oil Co.'s No. 1 McCrory, SE cor. Section 10-1s-3w, three-quarters of a mile from production, is preparing to drill deeper. It was plugged back and tested at 2,353-83 feet and did not show sufficient oil to make a producer and will be drilled deeper. The total depth of the test is 3,520 feet. Same company's No. 2 Hooks, NE cor. SE NE Section 24-1s-3w, is shut down waiting for cement to set. The test had a showing of oil at 1,842-2,005 feet and the total depth is 2,055 feet.

F. Gouin and others' No. 1 Burton, SE cor. SW NE Section 31-1s-2w, is pumping 50 bbls. a day under proration. The sand was found at 1,834-1,963 feet On south another test is showing oil and is estimated to be a 30-bbl. well. L. J. Woodruff and others' No. 1 Brady, NW cor. SW SW Section 32-1s-2w, is shut down with a showing of oil found at 1,741-2,300 feet.

In Stephens County

In Stephens County one producer and two failures were completed and one new location was announced during the week. G. Pace's No. 9 Watkins, NW cor. NE SE SE Section 21-2s-7w, swabbed 300 bbls. the first 24 hours from sand at 1,716-27 feet. The well was drilled deeper into the sand and increased its production.

S. B. Cooper and others' No. 1 Duncan, NW cor. NE Section 28-2s-7w, found a hole full of water after the cement plugs were drilled in sand at 1,688-99 feet A. L. Andree and others' No. 1 Patrick, C E half SE Section 3-3s-8w, is being abandoned at a total depth of 2,759 feet.

G. Pace's No. 10 McMasters, NE cor. NW NE Section 13-2s-8w, is a new location. Same operators' No. 5 Bush, SW cor. SE NE NW Section 3-3s-8w, on the southwest side of the Empire Field, found a showing of oil at 1,637-51 feet and is estimated at 15 bbls. a day. The well will be given a shot and completed.

Pipe Line to New Pool

The Continental Oil Co. has completed a 2-inch pipe line to the Reiter-Foster Pool, in Payne County, and is taking the oil produced in the area. Under the proration plan the wells have been allowed to produce 10 bbls. a day, each. On March 2 the wells were opened to determine the potential production, and will be prorated accordingly. The Continental Oil Co.'s new pipe line from the Oklahoma City Field to Tonkawa runs about 2 miles west of the Reiter-Foster Pool, and connection is expected to be made

(Continued on Page 178)

WILDCAT OPERATIONS IN OKLAHOMA

(Descriptions are East and North unless marked otherwise)

NORTHERN OKLAHOMA

ALFALFA COUNTY

Company, farm and location—	Remarks:
Smith Brothers' No. 1 Forbes, SE cor. NW NW Sec. 12-27-11w	Shut down 1,232 ft.
J. W. Bailey's No. 1 Acre, SW cor. NE Sec. 14-24-11w	Drlg. 5,213 ft.

BECKHAM COUNTY

Price-McFann's No. 1 Webster, C SW SW Sec. 34-8-26w	Shut down 1,180 ft.
Mid-Continent's No. 1 Schaff, C NE SW Sec. 22-11-22w	Waiting on cement to set 430 ft.
Mid-Texas Co.'s No. 1 Sidell, NE cor. SW SW Sec. 17-2-22w	Shut down 2,550 ft.
White et al's No. 1 Green, SW cor. Sec. 24-10-24w	Drlg. 2,830 ft.

BLAINE COUNTY

Washoma Oil Co. et al's No. 1 Phillips, C NW SW Sec. 13-19-10w	Pulling 6-in. csg. 4,590 ft.

CADDO COUNTY

Abernathy & Brown's No. 2 Houston, Sec. 24-6-13w	Shut down 1,115 ft.

COAL COUNTY

McGraw Oil Co.'s No. 1 Ward, NE SE Sec. 35-1-8	Shut down 250 ft.
Whitney et al's No. 1 Miller, SE NE Sec. 10-2-8	Shut down 760 ft.

COMANCHE COUNTY

Croy & Young's No. 1 Cline, NW NE NE Sec. 9-3-10w	Shut down 2,282 ft.
G. W. Stogner's No. 1 Doebel, C SW SW Sec. 3-3-9w	Shut down 1,450 ft.

CREEK COUNTY

Burton-Holmes et al's No. 1 Sankeye, SE SW SW Sec. 5-18-10	Shut down 2,177 ft.

GARFIELD COUNTY

E. L. Love et al's No. 1 White, SE cor. NW Sec. 9-24-6w	Shut down 5,835 ft.

GRADY COUNTY

J. V. Bailey's No. 1 Hubbard, C NE NW Sec. 1-10-6w	Shut down 100 ft.
Holden's No. 1 Phillip, SE cor. Sec. 3-19-18e	Shut down 1,860 ft.
Marion Oil's No. 1 Sanders, NW NE NW Sec. 10-9-18e	Shut down 2,337 ft.

GARVIN COUNTY

Malarnee et al's No. 1 Phillips, NE SW SE Sec. 24-2-2w	Location.

GREER COUNTY

French's No. 1 Murphy, SW NW Sec. 23-7-21w	Shut down 1,490 ft.

HARMON COUNTY

Harmon-Tex Oil Co.'s No. 1 Hoadley, NE cor. Sec. 17-4-24w	Shut down 2,593 ft.
S. M. Stauffer's No. 1 Castleman, SW NE Sec. 8-4-26w	Shut down 625 ft.

HARPER COUNTY

Empire's No. 1 Bruce, C NE SW Sec. 12-25-20w	T. D. 7,935 ft.; plugged back to 7,500 ft.
Sinclair Oil & Gas Co.'s No. 1 Howell, C SW SW Sec. 14-26-24w	20,000,000 ft. gas 5,350-5,400 ft.; total depth 8,539 ft.; shut down; sprayed 50 bbls. gasoline.

(Continued on Page 170)

Nineteen New Completions in Kansas

Ten Were Oil Wells With Initial Production of 7,457 Bbls. Three Good Gassers. Ritz-Canton States Leading Pool

By W. A. Spinney
Staff Correspondent, Kansas Fields

The Ritz-Canton area in McPherson County, Kansas, continues to be the most active area in the State with 79 operations. During the week 19 wells were completed in the State. Ten were oil wells with an initial daily production of 7,457 bbls.; three were gas wells with an initial daily flow of 53,000,000 feet and six were dry holes. Production of the State for the same period was 112,870 bbls. a day which is a decline from the previous week of about 3,000 bbls. a day.

The stripper wells in the eastern part of Kansas which have a production outlet until April 5, are located in Labette, Neosho, Allen, Anderson, Linn, Franklin, Miami, Coffey, Woodson, Wilson, Montgomery, Chautauqua, Elk, Greenwood, Cowley, Bourbon, Butler and Marion Counties. The 50-day relief period of the Standard Oil Co. of Indiana ends on the above date. Approximately 6,000 bbls. of oil a day is being taken by the Standard company from the above counties. The oil was formerly purchased by the Prairie Oil & Gas Co. for its own account, but when the Prairie found it necessary to withdraw as a common purchaser January 1, the stripper wells were left without a market. The shutting down of the old wells for about a month and a half is believed to have helped in some cases as the wells are making more oil after the rest than they did before. The operators kept the water down but did not otherwise operate the properties. What is to become of the oil from the stripper wells after April 5, is a matter of guesswork.

Governor Woodring is preparing to call a conference within the next few days in which every oil company doing business in the State will be asked to help handle a share of the stripper oil production, after the expiration of the Standard Oil Co. of Indiana's 50-day relief plan.

New Potential Figures

The potential production of the Ritz-Canton area in McPherson County, in central Kansas, which was the only area under proration, has 34 completed wells with a potential under the new unit system of 46,808 bbls. a day, according to Lloyd Pickrell, the new proration umpire in Kansas. The umpire estimates the actual potential production of the area at approximately 55,000 bbls. a day. The pool is divided into 40-acre units and 27 of these units are now producing.

The allowable production from the district is approximately 6,600 bbls. a day. The area is being prorated to approximately 15 per cent of potential capacity. The oil is being run to the Shell Pipe Line Co. which is handling 5,400 bbls. a day and the balance to the Texas Pipe Line Co., Empire Pipe Line Co. and Stanolind Pipe Line Co. Two new producing wells have been added to the Ritz-Canton area since these figures were checked.

The deep sand well, C. B Davis and Aladdin Petroleum Corp.'s No. 1 Ritz, SE cor. SW Section 19-19-1w, in the Ritz-Canton area, McPherson County, is rated as a 1,600-bbl. well. The well made 105 bbls. of oil the first hour and 066 bbls. the first nine and one-half hours, after a 30-quart shot. The oil was found in the Viola at 3,430-39 feet. The lease was farmed out by the Shell Petroleum Corp.

United Petroleum Co. and Stearns-Streeter Co.'s No 1 Blair, NW cor. Section 32-19-1w, was making 3,800,000 feet of gas from the chat at 2,940-67 feet. The well extends production to the southeast and will be drilled deeper. It is located a half mile from the deep sand production discovered by the Mid-Kansas Oil & Gas Co. in Section 30-19-1w.

In the Decker gas pool the McPherson Oil & Gas Co.'s No. 1 Salthouse, C SE Section 15-19-2w, was flowing 26 bbls. of oil an hour and 3,500,000 feet of gas a day from the chat at a total depth of 2,970 feet.

Location was announced for Prairie Oil & Gas Co. and Gypsy Oil Co.'s No. 1 Way, SE cor. Section 18-19-1w, on a 320-acre lease which was pooled. The acreage is located in the SE of Section 18 and NW of Section 20-19-1w.

Curtailment in Harvey

Production in Harvey County will be curtailed as soon as the potential has been established. The area has three producing oil wells and some of these wells are making water. Two of the wells will be prorated 15 per cent and the other will be produced wide open as it is making 30 bbls. of oil and 200 bbls of water a day. It is the second area in the State to be prorated. Washoma Petroleum Co. and others' No. 1 Zook in Section 36-22-2w, estimated at 650 bbls. in four hours, and Jones and others' No. 1 Lehman, in Section 35-22-2w, is making 200 bbls. of oil and 200 bbls. of water a day. All the wells are producing from the chat.

The deep drilling test in the Hugo gas field in southwestern Kansas is the Argus Production Co 's No. 2 Christopher, C NE Section 10-33-39w, Stevens County, and was drilling at 4,770 feet on the last report. The gas production in the area is found from 2,500-2,850 feet.

Western Kansas Oil Test

Another western Kansas area is to be tested for oil and the operation promises to be one of the outstanding wildcats in the State. The test is Carter Oil Co., Prairie Oil & Gas Co. and Mid-Kansas Oil & Gas Co.'s No. 1 Everett, C NE, Section 22-29-21w, in the southern part of Ford County. The slush pond is being built and material is being moved in. The companies expect to spud by March 20. The test will be drilled to about 4,500 feet with a rotary and then with standard tools to approximately 6,300 feet where the Wilcox sand is expected.

The test is located in the center of a block of about 28,000 acres on which the companies have been core drilling for four months, going to a depth of 1,800 feet in some of the tests. The oil companies have been surveying the territory and had no desire to drill at this time but owing to lease requirements the test must be started. South of the test about 15 miles the Watchorn Oil & Gas Co. has several deep gas wells. The gas being found in the Wilcox sand which was penetrated more than 100 feet. The Carter Oil Co. has another block of 5,000 acres adjoining the Everett block on the south which is located in Clark County.

Eastborough Production

Sedgwick County production outside of the Eastborough Pool, averaged 13,202 bbls. a day for the week ending February 28, a total of 153 wells with an average of 87 bbls. per well. By pool the production was as follows: Greenwich Pool, 29 wells, 4,370 bbls. a day; Valley Center Pool, 110 wells, 8,309 bbls.; Robbins Pool, 9 wells, 315 bbls.; Goodrich Pool, 3 wells, 170 bbls.; and Miller Pool, 2 wells, 38 bbls.

The new well of Study, Lloyd, Frost and others, No. 1 Haury, SE cor. NW, Section 1-23-4w, in northeastern Reno County, flowed 330 bbls. of oil the first 24 hours. The well was shut in pending the erection of another 500-bbl. storage tank. The oil was found in the chat at 3,254-3,364 feet. The first gas was found at 3,318 feet and the big pay at 3,342-64 feet. The well also makes approximately 7,000,000 feet of gas a day. The owners plan to produce the gas and to do this a certain amount of oil will also be produced. At the present time the operators are handicapped because of the lack of market for crude. The McPherson Oil & Gas Co.'s No. 1 is the east offset to the well and was drilling at 2,300 feet.

Showing in Morris County

A showing of oil was found in the wildcat test of Great Basin Oil Co.'s No. 1 Albright, SW cor. SE SE, Section 18-16-5, Morris County. The oil was found in the chat at from 2,264-90 feet. The well made 12 bailers of oil and 1 bailer of water in a few hours. The casing is being underreamed to the top of the chat and a production test will be made.

In the Lost Springs Pool in Marion County another well was completed in the north extension. R. Youker and others' No. 2 Riffel, SW cor. Section 11-17-4, made 80 bbls. a day on the pump from a total depth of 2,377 feet in chat.

In Russell County

In Russell County a new wildcat was announced and a well was completed in the Gorham Pool. Stearns-Streeter and Hall's No. 1 Miller, SE cor. SW SE Section 30-14-13w, is a new location and is about 6 miles north of the Ochs Pool. The area has been core drilled by the Skelly Oil Co., whose acreage is located east of the test. In the Gorham Field, Midwest Exploration Co.'s No. 22 Baxter, in Section 33-13-15w, swabbed 6 bbls. of oil an hour from a total depth of 3,081 feet, in the Oswald formation. Other tests in the county were J H. Liggett's No. 1 Witson, in Section 16-11-15w, was spudding. Keys Petroleum Co.'s No. 16 Baxter, in Section 32-13-15w, in the Gorham Pool, was a rig.

A showing of oil was found in a Saline County wildcat. H. C. Detrick and others' No. 1 Sudendorf, NE cor. SE Section 30-14-2w, had the top of the Viola at 3,265 feet, where a showing of oil was found. The 6-inch casing which was landed at 3,220 feet is being underreamed to the top of the Viola to shut off the water which broke in behind the casing causing the hole to cave. The casing was landed on top of the Viola and the drilling resumed at 3,360 feet.

The three producing wells in the State Line Pool, located southwest of Caldwell, on the Sumner County, Kansas, and Grant County, Oklahoma, border, under the proration agreement are making a total of 170 bbls. of oil a day. The Gypsy Oil Co.'s No. 1 Enderude is making 70 bbls. a day. Same company's No 2 Enderude is making 50 bbls. a day and the Stanolind Oil & Gas Co. and Amerada Petroleum Co.'s No. 1 Clark makes 50 bbls. a day. The discovery well has been abandoned. The pool during the last two years has shipped approximately 3,286 tank cars carrying about 650,000 bbls. of oil from the pool.

Deep Rock Oil & Refining Co.'s No. 1 Peavey, NE cor. SE Section 19-11-17w, north of the Shutts Pool, in Ellis County, is being abandoned at a total depth of 3,445 feet.

Cowley County

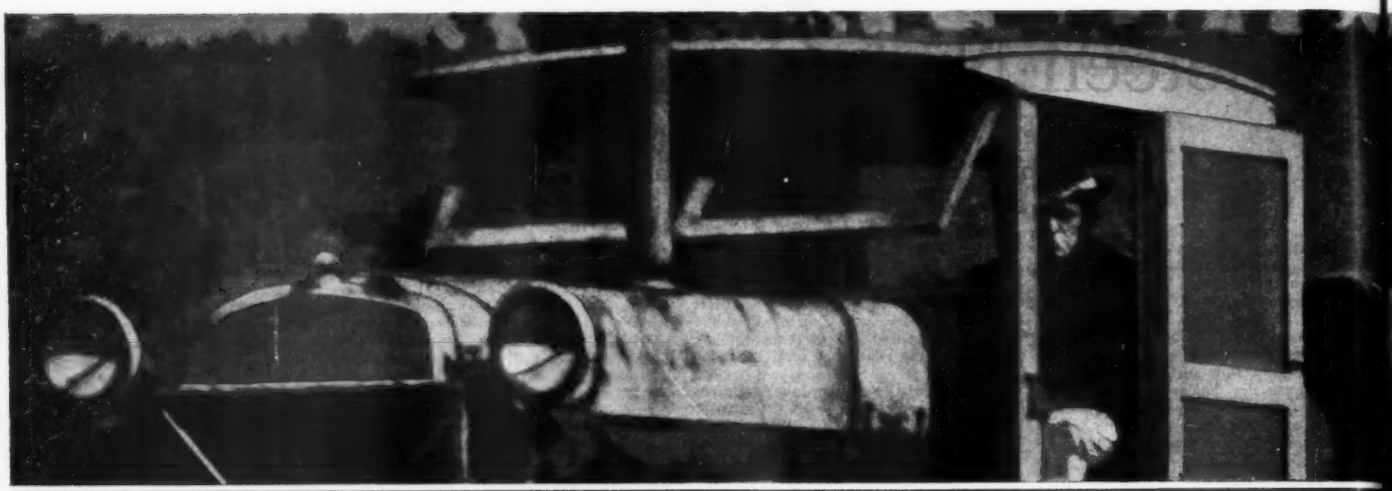
Sooby and others made location for No. 1 Bowman, NE cor. SE, Section 8-32-5. Long and others' No. 1 Carlisle, SW cor. SE SE, Section 35-34-3, is spudding. McKnabb & Bess' No. 1 Nelson, SE cor.

(Continued on Page 158)

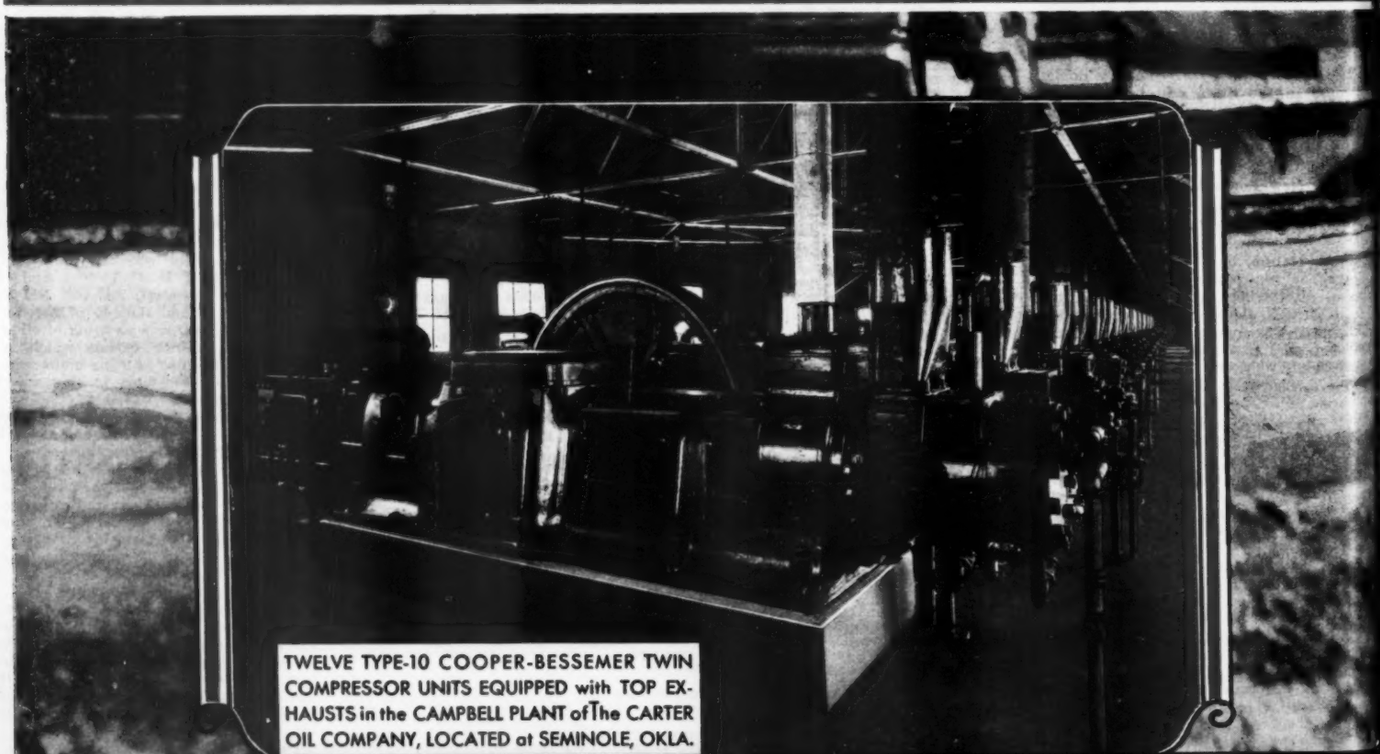
WILDCAT OPERATIONS IN KANSAS

(Descriptions are East unless marked otherwise)

Company, farm and location—	Remarks:
BARBER COUNTY	
Allison & Fitzwilliams' No. 1 Kumberg, SE SW SE Sec. 2-30-12w	4,790-99 ft.; show oil and hole full water; abandoned.
BARTON COUNTY	
Syndicate Oil Co.'s No. 1 Boertz, NW SE SE Sec. 13-18-12w	Drlg. 465 ft.
Skelton Oil Co.'s No. 1 Ott, C SE SE Sec. 16-19-14w	Drlg. 2,065 ft.
McCool et al's No. 1 Tsern, NW SE NE Sec. 12-20-11w	Shut down 1,600 ft.
CLARK COUNTY	
Watchorn's No. 2 Morrison, NW NE Sec. 20-32-21w	T. D. 6,909 ft.; plugged back to 6,530 ft. to test show gas; S.D.
CLAY COUNTY	
Crystal Oil et al's No. 1 Tivier, SW cor. Sec. 19-8-2	Shut down 2,390 ft.
COFFEY COUNTY	
Heyburg's No. 1 Kroft, SE SW SE Sec. 30-22-14	Shut down 1,300 ft.
Roberts et al's No. 1 Hay, SW SE NW Sec. 32-22-15	Shut down 1,250 ft.
COWLEY COUNTY	
Fisher et al's No. 1 Hurt, C SW SE SE Sec. 11-34-3	Rig.
Roth & Farout's No. 1 Reedy, SW NW NE Sec. 8-32-8	Shut down 1,040 ft.
Tom Fine's No. 1 Boyd, NW NE Sec. 23-32-4	Shut down 2,650 ft.
DICKINSON COUNTY	
Severs et al's No. 1 Lavengood, NE SW Sec. 13-13-2	Fishing 3,785 ft.
ELLSWORTH COUNTY	
Gilmore Oil et al's No. 1 Sturm, NW SW Sec. 31-17-9w	Drlg. 225 ft.
Hershey et al's No. 1 Schultz, C NE Sec. 9-14-8w	Rig.
Alyward et al's No. 1 Stratman, SE NW SE Sec. 1-17-10w	Total depth 610 ft.; shut down.
Aladdin Pet.'s No. 1 Stoddenberg, C SW Sec. 22-16-10w	Shut down 1,130 ft.
Milton et al's No. 1 Kester, SE NE Sec. 6-14-9w	Shut down 1,476 ft.; making 2,000,000 ft. gas.
Aladdin and Carter Oil Co.'s No. 1 Barecky, C NW Sec. 3-16-10w	Silicious 3,345-54 ft.; water; total depth 3,392 ft.; abandoned.
FORD COUNTY	
Carter Oil Co.'s No. 1 Everett, C NE Sec. 22-29-21w	Location.
Swain et al's No. 1 Taylor, C NW Sec. 21-25-24w	Drlg. 4,490 ft.
GOVE COUNTY	
Johnson and Atlantic's No. 1 Wright, SE NE Sec. 11-12-27w	Drlg. 4,865 ft.
GRAHAM COUNTY	
Schleimeyer et al's No. 1 Clark, SW NE NE Sec. 11-8-25w	Plugged back to 3,397 ft.; drlg. deeper; 3,715 ft.
GREENWOOD COUNTY	
T. K. Simmons' No. 2 Barnard, SW SE SE Sec. 19-22-12	Drlg. 1,700 ft.
HARPER COUNTY	
Beeler et al's No. 1 Bear, C NE Sec. 21-36-6w	Shut down 1,830 ft.
HARVEY COUNTY	
Empire-Shell's No. 1 Showalter, NW SE Sec. 23-23-2w	Shut down 1,565 ft.
KINGMAN COUNTY	
Skelly Oil's No. 1 Miles, NE cor. Sec. 30-27-10w	1,635-40 ft. 2,000,000 ft. gas; at 2,005-20 ft. 6,000,000 ft. gas; at 2,133-42 ft. 3,000,000 ft. gas; showing oil 3,385 ft.; T. D. 3,441 ft.; S. D.; estimated at 600 bbls. a day.
KIOWA COUNTY	
McKenna et al's No. 1 Ralston, C NE Sec. 14-28-20w	Rig; abandoned.



MORE TYPE-10's GOING INTO THE LINE



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Big Gas Wells in Shreveport Area

Two in Jackson, Miss., Field, One in Bethany, Tex., Area and One in Bossier Parish, La. Several Important Failures

By D. H. Bancroft
Staff Correspondent, Louisiana-Arkansas

SHREVEPORT, La., Mar. 2.—Four large gassers in three widely separated fields featured the week's developments in this territory. The Jackson Field in Mississippi furnished two; the Bethany Field in Panola County, Texas, one, and one in the Sligo Field in Bossier Parish, Louisiana. One of the Jackson wells extended production one-fourth mile north and was completed for an estimated 45,000,000 feet. This test, Mississippi Petroleum Co.'s No. 2 Baptist Orphanage, SE cor. NE SE, Section 28-6-1e, had the top of the chalk at 2,482 feet and drilled to 2,488 feet, total depth. The other completion in the Jackson Field was Love Petroleum Co.'s No. 1 Bob Taylor, NW cor. NE SW, Section 34-6-1e, which topped the chalk at 2,418 feet, total depth 2,423 feet, and was estimated at 35,000,000 feet. The Bethany gasser, Natural Gas Production Co.'s No. 1 H. H. Alvord, gauged 36,192,000 feet of dry gas from a total depth of 4,710 feet. This well was first tested at 4,698 feet, where they had 4,000,000 feet, but was deepened to 4,710 feet. It is producing from the Trinity horizon and makes the fourth successful completion in this area in the Trinity. The Sligo well was United Production Corp.'s No. 2 Schmitt, C SW NE, Section 14-17-12, Bossier Parish, which had 24,620,000 feet of dry gas with a rock pressure of 1,000 pounds at 2,465 feet.

Another Trinity Test

H. I. Morgan and associates have begun operations for another Trinity test in the Bellevue district of Bossier Parish, and are now drilling below 400 feet. This test is their No. 13-B Kendrick, and is located 2,840 feet east and 1,320 feet north of the southwest corner of Section 22-19-11. R. E. Davidson and others, drilling No. 1 Weiller, a wildcat, 4 miles south of Shreveport, tested dry with drill stem testing tool at 1,633 feet and 1,671 feet, and are reaming to make another test in sandy shale at 1,746 feet. Baird Brothers' No. 1 Whittaker, Section 30-20-7, Claiborne Parish, tested salt water with drill stem tester at 2,415 feet. Baugh and others' No. 1 Alexander, Section 27-20-8, Claiborne Parish, a wildcat 6 miles south of the Homer Pool, has been abandoned as a dry hole at 2,200 feet. Louisiana Oil & Refining Corp.'s No. 10 Langston, Section 29-21-7, deep test in the Homer Field, Claiborne Parish, is drilling in black shale with streaks of sand at 4,336 feet.

Louisiana Gas & Fuel Co.'s No. 1 Glanton, Section 23-17-6, Richland gas area, has been abandoned as a dry hole at 3,130 feet, having missed production at both the 2,450-foot and 2,900-foot horizons. Arkansas-Louisiana Pipe Line Co. has made location and is now rigging up for its No. 5-C Thomason, Section 21-16-6, Richland gas area, NW cor. SE NE of the above section.

Zwolle Field Disappointments

The Zwolle Field of Sabine Parish failed to develop a producer the past week, but entered the completion columns with three failures. One, a deep test, being A. H. Tarver trustee's No. 1 Baker, Section 36-8-12, was dry and abandoned at 4,127 feet. The Triangle Petroleum Co.'s No. 1 Sabine Lumber Co., Section 36-8-12, was junked and abandoned at 2,274 feet, and Pelican Natural Gas Co.'s No. 8 Louisiana Long Leaf Lumber Co., after testing a small show of oil, was abandoned at 2,550 feet. However, Zwolle received two new locations. Lacy Production Co. staked No. 3 Cooper, NW cor. SW NE, Section 30-8-12, and W. M. Coats has erected derrick for No. 2-A Sabine Lumber Co., NW cor. NW SW, Section 1-7-12. Ohio Oil Co.'s No. 6 Bowman-Hicks, Section 2-7-12, is standing 1,800 feet in oil at a depth of 2,509 feet and is waiting on standard rig to pump. D. M. Lide's No. 2 Ponder, Section 15-7-11, which showed for a 25-bbl. pumper at 2,520 feet, is being deepened. Magnolia Petroleum Co.'s No. 1 Lucius, wildcat south of the Zwolle Field, has reached a depth of 3,948 feet and is drilling in lime at the above depth.

United Gas Public Service Co. has "shot" with seismograph instruments in all directions around the gas area in Townships 19 and 20 north, Ranges 10 and 11 east in East and West Carroll Parishes, Louisiana, and practically the entire north half of West Carroll Parish, and at present are shooting in Morehouse Parish in Township 22, Ranges 8 and 9, where they recently obtained a large block. It is expected United Gas will begin one or more tests in this vicinity in the near future.

New Locations in Arkansas

Arkansas failed to enter the completions column, but obtained three new locations. Ohio Oil Co. has erected derrick for No. 3 R. Furlough, 408 feet north and 192 feet east of SW cor. NW NE, Section 12-17-14, Union County, in the Champagnolle district, and Marine Oil Co. has made locations for two tests in the Urbana district, being its No. 1-E Thompson, 330 feet north and 330 feet west SW cor. NW NE, Section 10-18-13, and No. 2-E Thompson, 330 feet north and 330 feet east SW cor. NE NE, Section 10-18-13. J. H. James trustee's No. 1 Fordyce Lumber Co. is arranging to make a drill stem test in sandy lime at 1,975 feet, where they claim a show of oil. This is a wildcat test in Section 11-9-15, Dallas County. Waldron Oil & Gas Co.'s No. 1 White, Section 17-3-29, Scott County, Arkansas, was junked and abandoned at 1,815 feet and they are skidding the derrick 20 feet west for a new hole.

Four Mississippi Failures

Four wildcats in as many different counties were abandoned as dry holes in the State of Mississippi. One of these tests, United Gas Public Service Co.'s No. 1 School Land, SW SW, Section 16-6-1e, Hinds County, may have some bearing on defining the northwest limits of the Jackson Field. This test, located 1¾ miles northwest of production, had the top of the black shale at 2,675 feet and was abandoned at 2,707 feet. Vicksburg Oil Co.'s No. 1 Donbush, Section 8-18-5, Warren County, was abandoned at 1,600 feet; Mississippi-Gulf Oil & Gas Co.'s No. 1 Pope, Section 35-8-16, Covington County, was dry and abandoned at 3,000 feet, and Collins and others' No. 1 J. M. Carter, Section 29-11-12, Neshoba County, had top of the Midway at 1,110 feet, top of the chalk 1,600 feet, and was dry and abandoned at 1,890 feet. In Clarke County near the town of Quitman, Gulf Refining Co. is rigging up for a wildcat test on its No. 1 Box, C NW SE, Section 11-2-15. Ohio Oil Co.'s No. 1 Cantrell, Section 16-15-5, Clay County, wildcat, is fishing for a lost bit at 2,920 feet. Dixie Petroleum Co.'s No. 1 Clark, NW cor., Section 6-16-5, Warren County wildcat, is reported as claiming a show of oil at 2,248 feet, and are now arranging to set 8¼-inch casing at 2,191 feet for a test. Collett-Carter Oil Co.'s No. 2 Blackmur, Section 14-11-4, Yalobusha County, is shut down at 2,426 feet, changing from 6-inch to 4-inch drill stem and will soon resume making hole.

New Locations in East Texas

Activity in the border counties of Texas developed three more new locations the past week. Shasta Oil Co.'s No. 1 B. E. Johnson, located approximately 1,500 varas east and 500 varas north of the southeast corner of the E. and S. T. Greer Survey, in the William Mason Survey, Marion County, is now building derrick and moving in rig. This test is located on a block of approximately 5,000 acres southeast of the town of Jefferson, Tex. Sloan Prospecting Co. is building derrick for No. 1 F. B. Sanford, approximately 300 feet north and 200 feet east of southwest corner of the F. B. Sanford 49-acre tract in the M. M. Vann Survey, Shelby County, 3 miles south of the town of Center, Tex. Also in Shelby County, I. M. Bradley has made location for No. 1 J. J. Ashberry, on the east line of the G. W. Mitchell Survey, 7 miles northeast of Center.

Interest in drilling wells is at present centered on S. D. Hunter's No. 2 Dougherty, W. D. Burris Survey, near the town of Hallsville, Harrison County, Texas, it being at a critical depth and expected to reach the sand, if any, in the next few feet. It is now drilling below 3,525 feet. This test is located 200 feet from the Shell-Rock Petroleum Co.'s No. 1 Dougherty, which was supposed to have cored some good-looking sand at around

(Continued on Page 183)

WILDCAT OPERATIONS IN LOUISIANA-ARKANSAS

(Rotary operations unless otherwise designated)

NORTH LOUISIANA

BIENVILLE PARISH

Company, farm and location—	Remarks—
Coyle Bros.' No. 1 Lawhon, 300 ft. N, 300 ft. E, SW cor. SE NE, Sec. 15-16-8	S.D. for csg; T.D. 2,866 ft.

BOSSIER PARISH

Andrews & Davlin's No. 1 Nattin, 100 ft. N, 250 ft. W, C, Sec. 15-22-14	S.D. 2,300 ft.
H. I. Morgan's No. 13-B Kendrick, 2,840 ft. E, 1,320 ft. W, SW cor., Sec. 22-19-11	Began drlg. Feb. 22; cmtd. 10-in. 147 ft; drlg. 315 ft.
Rombaugh et al's No. 1 Allison, SW SE, Sec. 10-19-13	Set 6⅝-in. 1,031 ft; dry; arranging to deepen; T.D. 1,600 ft.
R. O. Roy's No. 1 W. H. Hodges, C NW NW, Sec. 19-16-10	Drlg. shale and boulders 900 ft.

CADDO PARISH

R. E. Davidson et al's No. 1 Weiller, Sec. 33-17-13	Arranging D.S. test 1,671 ft.
Garry M. Gordon's No. 1 Hatcher, 560 ft. E, 600 ft. S, NE cor. NW, Sec. 11-17-15	Location.
R. H. Libby's No. 1 Foster (was Gooch et al's), Sec. 29-15-16	Drlg. shale 2,770 ft.
Pyramid O. & G. Co.'s No. 1 Wheeler, 3,200 ft. W, 75 ft. N, SE cor., Sec. 9-18-16	Began drlg. Feb. 19; cmtd. 10-in. csg. 450 ft.
United Prod. Co.'s No. 1 Emmons, 1,337 ft. E, 660 ft. N, SW cor., Sec. 27-23-16	Drlg. 3,002 ft.
United Gas Public Service Corp.'s No. 1 Fortner, 330 ft. S, 330 ft. E, NW cor., Sec. 5-22-16	(O.W.D.D.); old T.D. 5,005 ft.; rig up.

CALDWELL PARISH

Carter Bell's No. 1 Taylor, 150 ft. S, 150 ft. E, NW cor. NE SE, Sec. 17-14-4	Derrick.
Hudson et al's No. 1 Burton, Sec. 35-12-2e	Coring 2,540 ft.

CATAHOULA PARISH

National Drlg. Co.'s No. 1 Marsh McMiller, 70 ft. N, 100 ft. W, C, Sec. 26-9-6	W.O. 3,086 ft.

CLAIBORNE PARISH

Baird Bros. et al's No. 1 Whittaker, 600 ft. N, 400 ft. W, SE cor. NE, Sec. 30-20-7	D.S. test; S.W; W.O. 2,415 ft.

CONCORDIA PARISH

Ark.-La. P. L. Co.'s No. 1 Alexander, SE cor. S½, Sec. 47-3-9	Drlg. sand 2,400 ft.

(Continued on Page 170)

LOUISIANA-ARKANSAS PROVEN AREAS

NORTH LOUISIANA

BOSSIER PARISH—CARTERVILLE

Company, farm and location—	Remarks—
Del.-La. Dev. Co.'s No. 6 Bollinger, 330 ft. S, 220 ft. W, NW cor., Lot 17, in Lot 16, Sec. 31-23-11	Hole full oil; W.O.S.R.; 15 ft. broken sand; T.D. 3,217 ft.

BOSSIER PARISH—SLIGO

United Gas Public Service Corp.'s No. 1 Smith, 1,980 ft. S, 342 ft. W, NE cor., Sec. 14-17-12	Began drlg. Feb. 24; drlg. 150 ft.

CADDO PARISH—GREENWOOD

Calatex O. & G. Co.'s No. 1 Edgar, 1,460 ft. S, 1,900 ft. E, NW cor., Sec. 17-16-16	Location.
Calatex O. & G. Co.'s No. 1 McAnn-Alfred, 1,310 ft. S, 970 ft. E, NW cor., Sec. 17-16-16	Location.

CADDO PARISH—MOORINGSPORT

Falcon Oil Co.'s No. 5 Nunnally, 2,379 ft. N, 3,849 ft. E, SW cor., Sec. 29-20-15	Drlg. chalk 1,600 ft.

CADDO PARISH—OIL CITY

Trio Corp.'s No. 1 Levee Board, 212 ft. S, 500 ft. E, NW cor., Sec. 17-20-15	Setting 8-in. csg. 1,320 ft; T.D. 1,605 ft.

CADDO PARISH—PINE ISLAND

Haynes Bros.' No. 2 Spell, 956 ft. W, 200 ft. N, SE cor. SE, Sec. 15-21-15	Fishing bailer; T.D. 3,962 ft.

CLAIBORNE PARISH—HOMER

La. Oil Ref. Corp.'s No. 1 Langston, 660 ft. S, 528 ft. E, NW cor. SW SW, Sec. 19-21-7	Drlg. shale 4,235 ft.

DE SOTO PARISH—HOLLY

Standard Oil Co.'s No. 6-A Farmer, 200 ft. N, 200 ft. E, SW cor. NE NW, Sec. 5-13-13	Drlg. shale 2,842 ft.

MOREHOUSE PARISH

Bahan & Bahan's No. 4 Feazel, 900 ft. W, 330 ft. S, NE cor., Sec. 2-20-4	Location; reported drlg. in error.

OUACHITA PARISH

Jordan Drlg. Co.'s No. 7 Cole, 265 ft. S, 1,459 ft. W, NE cor., Sec. 49, in Sec. 50-18-4	Location; reported drlg. in error.
United Carbon Co.'s No. 6 Spade, 1,180 ft. S, 140 ft. E, NW cor., Sec. 27-19-4	Location.

RICHLAND PARISH

Ark.-La. P. L. Co.'s No. 5-C Thomason, 350 ft. S, 217 ft. E, SW cor. NE NE, Sec. 21-16-6e	Rig up.

(Continued on Page 171)

New Pool in Northern Duval County

Twenty New Locations Announced in Southwest Texas. Most of Them Are in Unproved Territory. More Wells in Escobas Extension

By B. D. Stevenson
Staff Correspondent, Southwest Texas Fields

SAN ANTONIO, Tex., Mar. 2.—Al Buchanan got a 10-bbl. well from sand at 1,510-19 feet in his No. 2 Welder-Wood in the northern part of Duval County in Survey 215 and about 8 miles north and a little east of the Schoolfield - O'Byrne Pool. It opens a new pool. Total depth of the hole is 1,521 feet and it is shut down awaiting decision to drill deeper. There is a lot of good geology in the northern central part of Duval and just north of it in the south central part of McMullen. A little northeast of the Buchanan well the Humble did a lot of prospecting a few years ago and others before Buchanan drilled in and around Survey 215 and the logs of the tests drilled have pointed to favorable conditions for a pool. No. 1 Welder-Wood drilled by Buchanan got a little oil and gas but some salt water with it at about the depth that No. 2 has made a small well. At any rate the well is big enough that that part of the country will not be abandoned by the operators. The Magnolia's pipe line from Laredo to Luling is close by the well.

Evans & Sprinkle's No. 1 Auld in Real County is drilling dry formations right at the depth where No. 1 Love in Kerr County got its first oil. Slick interests are drilling the plugs in the first test since their No. 1 Poetter opened a new pool in Goliad County. Houston Oil Co.'s No. 4 Brown Land & Cattle Co. is trying to blow in at 4,846 feet from a new deep sand in the Cartwright Field.

In the S. R. C. Pool in northwestern Duval County another dry hole was chalked up when the S. R. C. Oil Co. and the Vacuum Oil Co. bailed dry their No. 3 Duval County Ranch Lands in sand at 1,741-44 feet. The depth is the same as No. 1 which came in an oil well and this is the third dry hole drilled since with no producers completed. Two of the dry holes have been drilled by the S. R. C. and Vacuum companies and one by The Texas Company. The first test did not look so very good right at first but when completed made about a 300-bbl. well.

In Pettus Area

T. B. Slick estate was drilling plugs in No. 1 Allen, 20 miles northeast of the Pettus townsite and in Goliad County, late in the week. After that liner will be set and tubing run and it was expected to be early this week before the results would be known. This well is about 1,500 feet from the discovery well, No. 1 Poetter, and is the first drilled since the discovery well. It has shown up well and ought to be a twin producer to the discovery well with total depth 4,212 feet, the same as in the discovery well.

Henderson Coquat completed a gas line from the Pettus townsite pool to Three Rivers, about 25 miles west and is furnishing gas to a power and light plant and to the town of Three Rivers and other industries using the gas from the Glasscock wells. Along with the gas a lot of natural gasoline is taken out of the pipe and disposed of.

There are no tests drilling in the Pettus area in sure-shot proven territory and the interest is in tests drilling on the edges or along lines expected to pick up extensions.

United Production Co.'s No. 34 Ray late in the week topped sand at 3,945 feet that showed 180 feet of oil with 500 pounds pressure on a two-minute drill stem test. It is 900 feet east of nearest production in the Ray-McKinney Pool of the Pettus area and got the sand at the right depth to extend the pool.

North of Ray-McKinney Pool

Up northeast of the Pettus townsite a few miles where William F. Morgan last year got a gas well at about 3,680 feet and where later the United Production Co. got a well making a little oil at the same depth, United Production Co.'s No. 32 Ray lost out on the 3,600-foot and got salt water at 3,692 feet and is now down to below 3,900 feet and drilling. That spot which has not been named as a separate pool but is in the Habermacher Survey about 2½ miles almost due north of the Ray-McKinney Pool thus consists of two wells producing from about 3,680 feet, with two gas wells, one the original discovery well of the area, producing from about 2,900 feet, half way between them and the Ray-McKinney Pool.

Southwest of the Pettus townsite, J. L. Mauldin has tried four times to get a drill stem test in his No. 1 fee but without success, due, it is claimed to the strong pressure. Total depth is 3,832 feet and production in the townsite is at 3,900 feet. It was thought for a time the limits of production on the southwest of the townsite was reached some months ago.

Mauldin & Fisher, 7 miles southwest of the townsite and near Grayburg's No. 1 Kimball that made a small amount of oil, have spudded in their No. 1 Kimball and shut down.

Six miles south of the Pettus townsite just west of Normanna, Nichols and others' No. 2 Hicks, completed a year ago, the only oil well there, has been worked over by setting a lead seal and the production has been increased from 25 bbls. daily to 50 bbls. The sand depth is 3,615-41 feet. There is one gas well nearby producing at 2,000 feet.

The only other spot around Pettus drawing special attention is the Simms gas pool on the Holzmark farm. The company's second test, No. 2 Holzmark made nearly as good a gas well as No. 1, but has had some water supposed to be coming from above and a string of casing has been set at 1,500 feet to shut it out. Total depth is 3,512 feet.

Kerr-Real Counties

Evans & Sprinkle's No. 1 J. M. Auld, in Real County, 5 miles northwest of No. 1 Jeff Love, discovery well in Kerr County, at 2,540 feet late in the week was within 12 feet of the depth where No. 1 Jeff Love got its first show of oil. It is generally thought No. 1 Jeff Love was good for a small well at 2,552 feet barely possible to get into the classification of commercial, and No. 1 J. M. Auld is in the right direction to pick up the same proposition at somewhere near the same depth.

No. 1 Jeff Love now producing and carried by most as 3,391 feet total depth, but probably somewhat deeper, is putting in a new pump that will handle a greater amount of fluid on account of the water coming with the oil. Other tests in that part of the country are not deep enough to be interesting at this time.

SOUTHWEST TEXAS PRODUCTION

Agua Dulce	17
Bexar County	349
Branyon	23
Bruner	16,297
Buchanan	105
Chapman	3,951
Dale	272
Darst Creek	29,278
Goliad County	42
Kingsville	119
Larremore	18
Luling	9,135
Lytton Springs	714
Manford	15
McMullen County	20
Medina County	22
Minerva	404
Mirando district*	13,321
Normanna	26
North Pettus	287
Pettus	6,984
Saxet	186
Somerset	1,362
S.R.C.-Vacuum	149
Thrall	35
White Point	42
Yoast	180
Total	83,333
Week ended February 21	85,986
Decrease	2,653

*Includes Charco-Redondo, Jennings and Mirando Valley of Zapata County; Abercas, Aviator, Caroline-Texas, Mid-O-Juelos, Schott and Wolcott, Webb County; Alworth, Henne-Winch-Fariss and Randado of Jim Hogg County; Cole, Driscoll, Kohler, Schoolfield- 'Byrne of Duval County.

Cartwright Field

Business picked up in the Cartwright gas field in the southeastern part of Live Oak County early in the week when the Houston Oil Co.'s No. 4 Brown Land & Cattle Co. tried to blow out at 4,846 feet from an entirely new sand for that field.

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SOUTHWEST TEXAS PROVEN AREAS

DOBROWOLSKI POOL—BEXAR COUNTY

Company, farm and location—	Remarks:
Morgan Bros.' No. 3 Masterson, 300 ft. S of No. 2 Masterson, Miguel Gortaris Sur.	T. D. 550 ft.; set csg.
Rolling & Michael's No. 1 Adams, Miguel Gortaris Sur.	T. D. 700 ft.; (W.O.).
F. H. Eckert's No. 1 Dobrowolski, 400 ft. from W line, 150 ft. from S line of lease, Sur. No. 52	Location.
A. J. Swearingen's No. 6 Sandemer, 600 ft. S of No. 1, M. Manchaca Sur.	Location.
A. J. Swearingen's No. 7 Sandemer, 300 ft. S of No. 6, M. Manchaca Sur.	Location.

BRUNER POOL—CALDWELL COUNTY

Joe Bruner's No. 1 Malone, A. Floyd Sur.	T. D. 50 ft.; spudded.

EDDINGTON POOL—FALLS COUNTY

Eddington et al's No. 2 Llewellyn, George Allen Sur.	T. D. 1,086 ft.; comp. 10 bbls.
Eddington et al's No. 3 Llewellyn, Geo. Allen Sur.	Rigging up.

DARST CREEK FIELD—GUADALUPE COUNTY

Gulf Prod. Co.'s No. 16 T. Dix, J. R. Robinson Sur.	Derrick.
Humble Oil's No. 22-A Denman	T. D. 2,596 ft.; comp. 900 bbls.
Humble Oil & Ref. Co.'s No. 23-A Denman	Location.
Magnolia Petroleum Co.'s No. 1 M. E. Roamel, J. Robinson Sur.	T. D. 2,405 ft.; drlg.
Magnolia Petroleum Co.'s No. 7 Klein	T. D. 2,630 ft.; comp. 650 bbls.
Simms Oil Co.'s No. 5 Manford, James Hodges Sur.	Rigging up.
Sun Oil Co.'s No. 1 Dowdy, J. C. Darst Sur. No. 9	Spudded.
Sun Oil Co.'s No. 14 Knoblock, J. R. Robinson Sur.	Derrick.
Sun Oil Co.'s No. 14 Knoblock, midway between Nos. 9 and 2, J. W. Robinson Sur.	T. D. 1,000 drlg.

CHAPMAN POOL—WILLIAMSON COUNTY

W. D. Anderson's No. 6-A T. P. Simmons	Temporarily abandoned.
W. D. Anderson's No. 8 M. V. Lawrence	Temporarily abandoned.
Bartlett & Wilson's No. 2 R. E. Stewart	T. D. 790 ft.; temporarily abnd.
Bartlett & Wilson's No. 1 R. E. Stewart	T. D. 741 ft.; temporarily abnd.
Chapman et al's No. 2-E Sides	Location abandoned.
Chapman's No. 4-F Sides, S. Miller Sur.	T. D. 1,812 ft.; set csg.
Collins et al's No. 6 Lawrence	T. D. 1,655 ft.; set csg.
Collins et al's No. 8 Lawrence, S. Miller Sur.	Rigged up.
J. L. Collins & Co.'s No. 7 M. V. Lawrence, 150 ft. from E line, 215 ft. from S line of 27-ac. tract in the S. Miller Sur.	Temporarily abandoned.
E. E. Ertell's No. 7 J. C. Abbott	T. D. 100 ft.; temporarily abnd.
J. L. Collins & Co.'s No. 5 M. V. Lawrence, 150 ft. from W line, 515 ft. from S line of 27-ac. tract, S. Miller Sur.	T. D. 1,402 ft.; abandoned.

(Continued on Page 176)

WILDCAT OPERATIONS IN SOUTHWEST TEXAS

ATASCOSA COUNTY

Company, farm and location—	Remarks:
Cullen and Boren's No. 1 Medina Irrigation, W. Klemke Sur. No. 439	T. D. 2,267 ft.; shut down.

BLANCO COUNTY

H. L. Lewis' No. 1 Glasscock, moving in to drill on leases out of the Rodson block north of Blanco City	T. D. 500 ft.; shut down.
Hardy-Sitton's No. 1 McMillan	T. D. 570 ft.; shut down.
Lles-Adams et al's No. 1 Stanford, 150 ft. to S line, 1,420 ft. to E line of James Stanford's No. 155	T. D. 952 ft.; drlg.
McCleary et al's No. 1 Schenling, 900 ft. to SE line, 600 ft. to S line of J. A. Rouse No. 118 Sur., 4 miles SW from Blanco City	T. D. 562 ft.; shut down.
J. R. Meek's No. 1 Walker, 360 rds. from W line, 482 rds. from S line of 375-ac. tract in Sur. No. 32	T. D. 1,025 ft.; fishing.
Page et al's No. 1 Cox, Rutersville College Sur. No. 18	Spudded and shut down.
G. Rosenfield's No. 1 Hohenberger, 800 ft. to W line, 1,250 ft. to N line, Sur. No. 94	T. D. 712 ft.; shut down.

BASTROP COUNTY

Majestic Pet. Co.'s No. 1 J. M. Breeding, 160 ft. from N line, 1,020 ft. from W line of 200-ac. tract, 940 varas from W line, 1,225 varas from S line of M. Andrews Sur., 13 miles W from Smithville	T. D. 375 ft.; standing.
Turner-Whorton and Anderson's No. 1 Harris, Joshua Gray Sur.	Ready to spud.

BELL COUNTY

Mildon Oil Co.'s No. 1 J. K. Edds, Maxiano Moreno Sur.	T. D. 260 ft.; drlg. shale.
J. W. Riley et al's No. 1 J. W. Mosely, Maxiano Moreno Sur.	T. D. 1,130 ft.; dry and abnd.

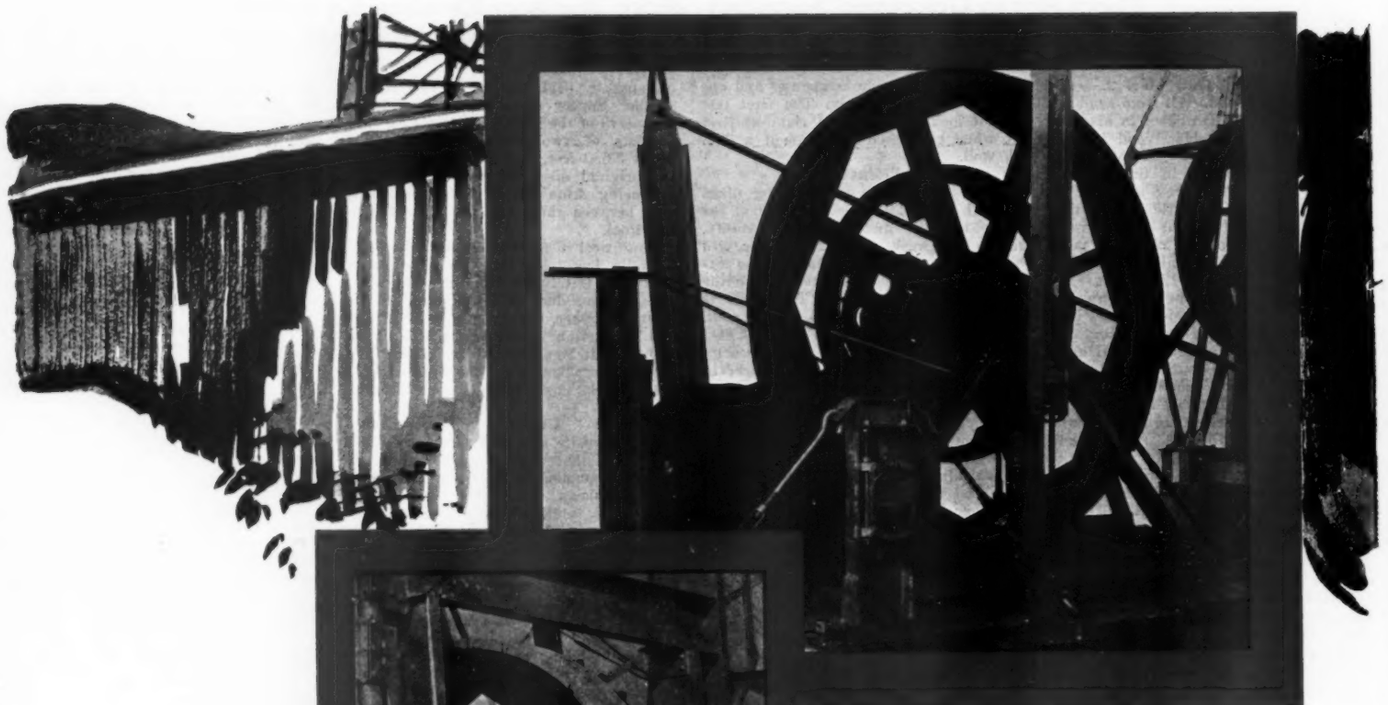
BROOKS COUNTY

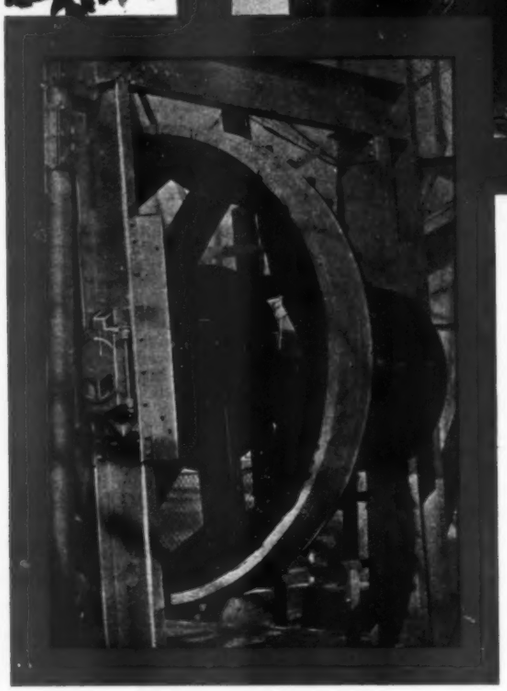
Ed East's No. 3 B. Garcia, 150 ft. from N and W lines of Blk. 5, Share A-1, Las Mastena y Gonzalene grant	T. D. 1,002 ft.; standing.

BEE COUNTY

Hurlbut et al's No. 1 Mrs. D. Chestnut	T. D. 5,010 ft.; shut down.
Hicks and Patton's No. 1 Billingsley, B. Q. Hadley Sur., 1½ miles N Grayburg's No. 1-A Kimball	T. D. 1,640 ft.; drlg.
Catlell and O'Neill's No. 1 Miller, Ronald Hotchkiss Sur.	Location.
Mauldin et al's No. 1 Kimball, 300 ft. S Grayburg's No. 1-A Kimball, S. Winship Sur.	Rigging up.
E. S. Price's No. 1 Weiss, 200 ft. each way out of NW cor. of B.&B. Sur.	T. D. 4,429 ft.; preparing to swab.

(Continued on Page 176)





Upper illustration shows the Moore self-aligning pitman bearing in position on the wrist pin, also the self-aligning tail post bearing on the friction sand reel, assuring free, smooth running.

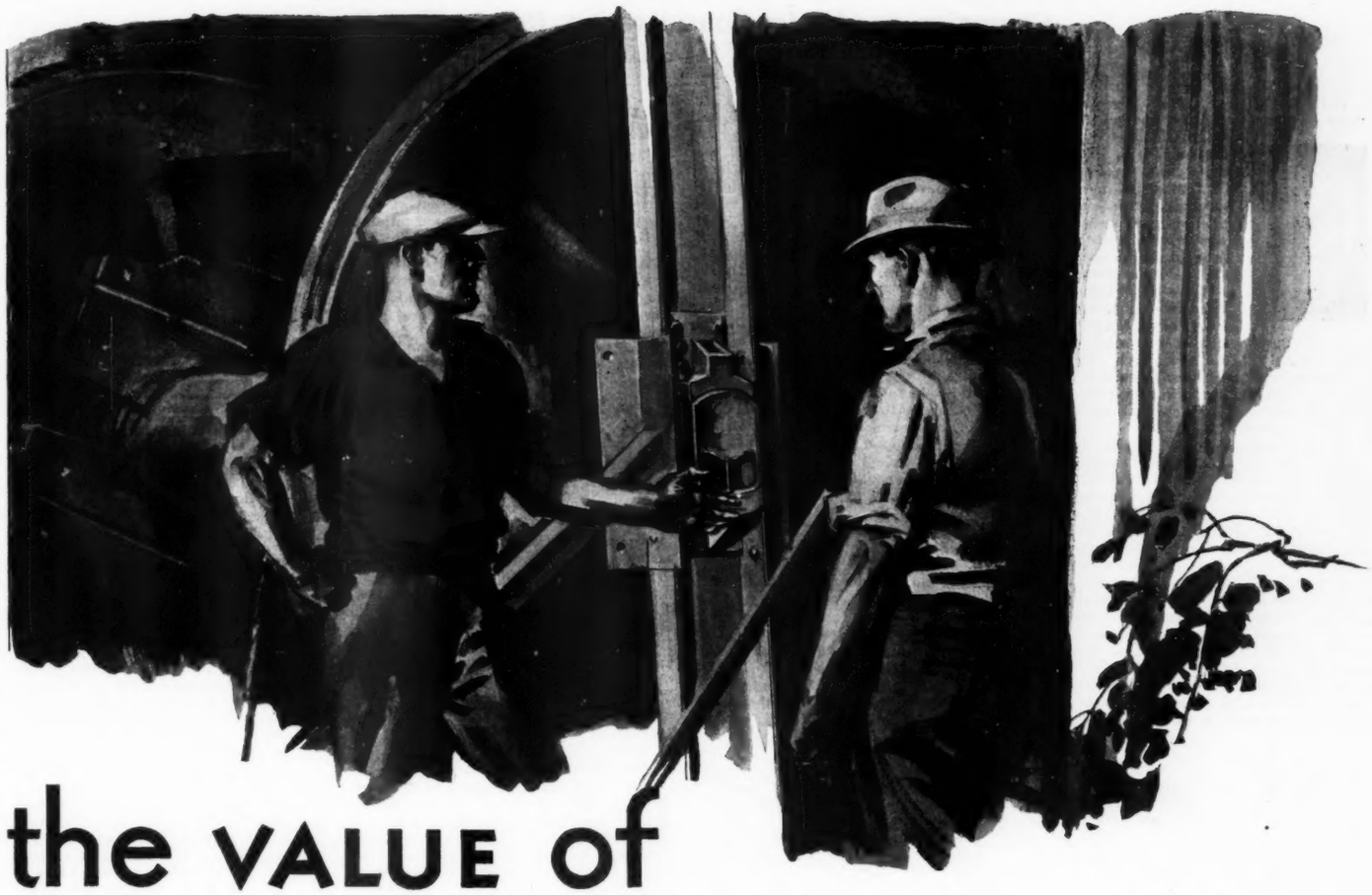
Lower illustration shows the Moore calf wheel post self-aligning bearing, showing oil reservoir on top for easy lubrication.

You'll see

An outstanding feature of Moore equipment is the Moore self-aligning bearing. Unusual and unexpected drilling conditions have made it highly important to develop a device so flexible, efficient and fool-proof.

Moore bull and calf wheel posts, the Moore pitman, the tail post and swing lever for the Moore friction sand reel—vital points that are subject to unusual stress or strain—all are equipped with Moore self-aligning bearings. Slight irregularities in a gudgeon or shaft, or deflections in a shaft under heavy load, often prevent

Moore BULL and



the VALUE of SELF-ALIGNING BEARINGS

a wheel from turning on its true axis. Ordinarily, the result is increased friction, unnecessary wear on the bearings, frequent rebabbitting and, of course, decreased operating efficiency.

In Moore bull and calf wheel posts, the bearing is free to adjust itself to the wheel gudgeon, permitting the wheel to turn freely. This automatic adjustment, together with the new effective means of lubrication provided, assures an even, free bearing surface at all times. The result is less friction, less rebabbitting and a bearing surface that lasts indefinitely. For extra heavy work, bearings can be furnished with cast white brass linings or bronze bushings.

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CALF WHEEL POSTS

Routine Completions on Gulf Coast

Field Work Is Quiet but Plans for an Active Drilling Campaign Are Under Consideration. Recent New Pools

By Neil Williams
Staff Correspondent, Gulf Coast Fields

HOUSTON, Tex., Mar. 2.—Completions on the Gulf Coast the past week offered little of interest. Barbers Hill, Refugio and Pierce Junction continued in the foreground with active drilling programs under way. New wells were brought in in the first two fields mentioned as well as in other scattered fields, but for the most part these were routine. The week also was marked by comparatively little new work started, but operations under way promise a long series of developments in the early future. Production on the Coast reflected a slight increase.

At Refugio, located in the lower coastal district, there was a small extension eastward of the 6,400-foot producing horizon by Moody-Seagraves-Smith's No. 1-B O'Brien. This well, 150 feet out of the SW cor. of the 12.5-acre tract in the Refugio town tract, approximately 800 feet east of the nearest 6,400-foot well, was completed flowing 420 bbls. of pipe line oil daily through three-sixteenths-inch chokes, having a pressure of 975 pounds on the casing and 1,200 pounds on the tubing. The sand is at a total depth of 6,462 feet with 23 feet of 4-inch screen. This extension is a part of the steady expansion which has marked the 6,400-foot horizon in the last several months, proving up a large territory on the east side of the original 3,700-foot field.

Two other 6,400-foot wells and one in the 3,700-foot area were completed at Refugio, but these were strictly inside of production and only served to add to the long string of producers which have been and are being brought in. Moody-Seagraves Producing Co.'s No. 1 Strauch, located in the center of Block 64 of the townsite, was brought in making 150 bbls. of high gravity oil (gasoline) from sand at 6,444-55 feet, setting 19 feet of screen. This flow is through a five-sixteenths-inch and a quarter-inch choke with 2,100 pounds working pressure. United Production Corp.'s No. 8 Power, Block 82 of the townsite and located diagonally northeast of Block 64, in which is the Strauch completion, came in spraying 15 bbls. of "gasoline" with 8 feet of screen set in sand at 6,448-56 feet. This is on two quarter-inch chokes with working pressure of 2,100 pounds. This production since has increased to above 60 bbls. daily. United Production Corp.'s No. 6 Nancy Ryals, in the old 3,700-foot area and located west of the townsite, is a 700-bbl. well at 3,654 feet with 8 feet of screen.

Important Extension Tests

Two important extension tests at Refugio had not been completed late in the week. These were Moody-Seagraves Producing Co.'s No. 1 Hayser, on the extreme south of the old Refugio area, which was swabbing after setting 21 feet of screen at 6,437 feet, and T. P. Morgan's No. 1-B St. John, west offset to Moody-Seagraves Producing Co.'s No. 1 St. John, wildcat 5,500-foot producer a mile south of the deep production. The latter has 17 feet of screen set at 5,517 feet. The Hayser test is a good mile and a half southwest of deep production.

At Barbers Hill, McAlbert Oil Co. got a good well in its No. 4 Woodward on the east side of the dome. This well, deepened from 5,316 feet, where it formerly was producing, to 5,454 feet, set 22 feet of screen and was completed flowing 61 bbls. hourly through two three-eighths-inch chokes with pressure of 260 pounds. Mills Bennett Production Co.'s No. 1 Gulf Smith, west flank, which came in the previous week flowing at the rate of 500 bbls. daily on a five-eighths-inch choke but which stopped flowing, has been put on the pump and now is making around 150 bbls. Production is at 5,573 feet.

Humphreys Corp.'s No. 10-A Kirby, on the extreme northwest side of Barbers Hill, has been abandoned as dry at 6,955 feet. This test is approximately 1,000 feet to the northeast around the dome from the nearest deep production there. It is the fifth test drilled and the first failure since deep production was discovered in that sector early in 1930. The other wells are from a horizon around 6,400 feet. This well drilled through cap rock and salt, topping cap at 3,015 feet and salt at 3,120 feet, the bottom of the latter being 3,248 feet.

The chief interest at Barbers Hill continues to be centered on the proving up of the west flank of the dome, where 11 rigs now are operating, stretching along a line approximately 2,500 feet long. These do not include rigs on the southwest flank, northwest flank, north or other sides of the dome.

Wilson-Broach's No. 7 Wilson, 250 feet west and 379 feet east of the SW cor. SE NE, Section 33-10s-12w, in the north extension area of Vinton, Calcasieu Parish, Louisiana, was completed flowing 610 bbls. of pipe line oil on a half-inch choke from sand at 3,432 feet, 23 feet of 3-inch screen being set. This is one of a series of good wells which have been completed in that pool from a 3,400 and 3,600-foot sand.

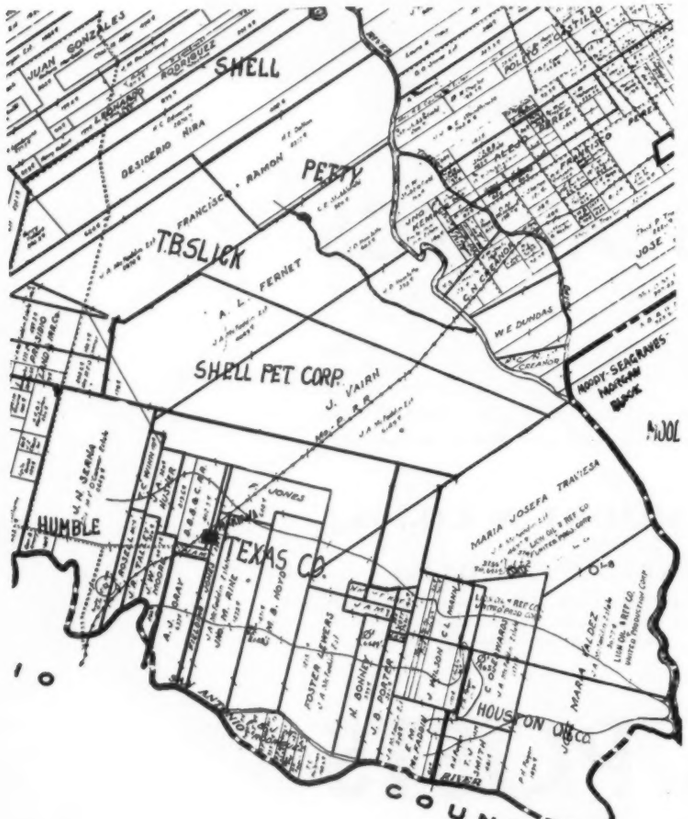
In the Esperson (Sheeks) Field, western Liberty County, Cranfill-Reynolds Co. added two more good wells, No. 8 Moores Bluff and No. 18 Esperson. The former, on the extreme west end, is flowing 175 bbls. daily with three joints of 4½-inch screen set at 2,329 feet. No. 18 Esperson has one joint of 4½-inch screen at 3,079 feet and is flowing 450 bbls. daily.

Miscellaneous Completions

Other completions for the week included Humble Oil & Refining Co.'s No. 4 Diemar, Raccoon Bend, Austin County, flowing 218 bbls. in the first 24 hours at 3,455 feet; Sun Oil Co.'s No. 5 Witt, Clay Creek (Gay Hill), Washington County, flowing 125 bbls., 1,273 feet; Vacuum Oil Co.'s No. 12 Miller, Lockport, Calcasieu Parish, 750,000 feet gas, 800 pounds pressure, 3,791 feet; Marrs McLean's No. 12 Cade, High Island, 574 bbls. net oil, 75 per cent water and b.s., seven-sixteenths-inch choke, 3,724 feet; Harrison Oil Co.'s No. 4 Quintette, North Dayton, 300 bbls., 4,481 feet; John Deering's No. 2 Bennett, Humble, pumping 25 bbls., 4,374 feet; Yount Lee Oil Co.'s No. 59 McFaddin, Spindletop, 450 bbls., 5,019 feet.

Mills Bennett Production Co. has abandoned its No. 3 Allen, southeast side of the Allen Dome, Brazoria County. It was quit in salt at 3,528 feet, topped at 1,520 feet. The test was started to drill through salt but a fishing job and the

(Continued on Page 158)



Map of Bloomington-Mariana district of southwestern Victoria County, where The Texas Company's No. 2 McFaddin blew in last week indicating possibility of second gas field. The Texas Company's wildcat, a gasser at a total depth of 2,025 feet, is approximately 4 miles west of two large gassers completed late in 1930 by Lion Oil & Refining Co. and taken over by United Production Corp. The latter company has made location for a third test on the Lion-United block. The area bears a close resemblance to the early development of the Refugio Field, approximately 30 miles westward, and also to the Pettus area of Bee County.

GULF COAST FIELDS AND WILDCATS

Week Ended February 28

All Rotary

BARBERS HILL—CHAMBERS COUNTY

Mills Bennett Prod. Co.'s No. 1-B Barber, north	Lime 4,847-52 ft.; cmtd. csg.
Mills Bennett Prod. Co.'s No. 5 Higgins, southeast	Drlg. lime 4,887 ft.
Mills Bennett Prod. Co.'s No. 1 Gulf-Smith	Set 69 ft. 5-in. screen 5,573 ft.; comp. pumping 375 bbls. oil.
Mills Bennett Prod. Co.'s No. 2 Gulf-Fisher, Wm. Bloodgood Sur., 400 ft. from S line and 50 ft. from W line lease (workover)	Pulling screen to deepen 4,769 ft.
Humphreys Corp.'s No. 2-B Barber, north	Total depth 3,491 ft. in sandy lime; milling on drill pipe.
Humphreys Corp.'s No. 1 Louise Fitzgerald, north	Total depth 5,379 ft. in salt.; drlg. sidetracked hole in water sand 4,505 ft.
Humphreys Corp.'s No. 2 Wilburn, southeast	Drlg. sandy shale 2,301 ft.
Humphreys Corp.'s No. 10-A Kirby (workover)	Abandoned in hard sand 6,955 ft.
Humphreys Corp.'s No. 1 Lula Barber, west flank, W. D Smith Sur., 50 ft. from N line and 50 ft. from E line of tract	Drlg. gumbo and shale 2,010 ft.
Humphreys Corp.'s No. 1 E. H. Winfree, west flank, W. D. Smith Sur., 50 ft. from S line and 75 ft. from W line of tract	Drlg. sand and boulders 2,466 ft.
Humphreys Corp.'s No. 2 E. H. Winfree, west flank, W. D. Smith Sur., 50 ft. from W line and 478 ft. S line 10-acre tract	Drlg. sand and boulders 1,042 ft.
Humphreys Corp.'s No. 3 E. H. Winfree, west flank, W. D. Smith Sur., 264 ft. from S line and 50 ft. from W line of 10-acre tract	Derrick.
Humphreys Corp.'s No. 4 E. H. Winfree, west flank, W. D. Smith Sur., 50 ft. from W line and 617 ft. from S line 10-acre tract	Location.
McAlbert Oil Co.'s No. 4 Woodward (workover)	Set 22 ft. screen 5,454 ft.; comp. flowing 61 bbls. pipe line oil hourly on two ¾-in. chokes; pressure 260 lbs., gravity 26.8°.
McAlbert Oil Co.'s No. 8 Woodward, east flank	Rig standing.
Rio Bravo Oil Co.'s No. 2 Fisher, west flank	Drlg. rock 3,083 ft.
Sun Oil Co.'s No. 8 Chambers, south	Drlg. salt 2,512 ft.
Sun Oil Co.'s No. 1 Smith, west	Drlg. shale 4,710 ft.
Sun Oil Co.'s No. 14 Wilburn fee, east	Rock 1,308 ft.; drill pipe stuck.
The Texas Company's No. 1 Williams, southwest	Drlg. hard sand 6,818 ft.
The Texas Company's No. 2 Winfree, west flank, W. D. Smith Sur., 264 ft. N, 50 ft. W at right angles out of SE cor. of lease	Drlg. gumbo 1,434 ft.
The Texas Company's No. 3 Winfree, west flank, W. D. Smith Sur., 478 ft. N and 50 ft. W at right angles out of SE cor. of lease	Drlg. rock 3,240 ft.
The Texas Company's No. 5 Wilburn, east flank, Wm. Hodges Sur., 400 ft. SW of No. 4 Wilburn and 50 ft. from SE line of lease	Derrick.

(Continued on Page 173)

Hobbs Extension Test Finds Water

In the Pool Proper Drilling Is Confined to One Well. Deep Test on Wellington Dome in Colorado Disappoints

By Tolbert R. Ingram
Staff Correspondent, Rocky Mountain Area

DENVER, Colo., Mar. 3.—The National Securities Oil Co.'s No. 1 Linam, 4 miles west of the Hobbs Pool, found sulphur water in the Hobbs pay at 4,265-72 feet and is shut down for orders. The Midwest Refining Co. completed its No. 8 Terry for 3,388 bbls. daily, leaving only one well drilling in the Hobbs Pool. The California Co.'s No. 1 Meredith, in the Eunice Pool, encountered more gas, and the Atlantic Oil Producing Co.'s No. 1 Coleman had 500 feet of oil in the hole at 3,833 feet. One new location was made in the Jal area, where no drilling has taken place for several months.

The Continental Oil Co. has reached the top of what is believed to be the Sundance sand on the Wellington Dome in Colorado without encountering any new pay. This leaves the Muddy as the only producing horizon in that field. The lease play in eastern Colorado is continuing without abatement. The wells around Denver show no important change from last week.

The Midway Dome test in Wyoming, which was drilled into the second Wall Creek last year, is to be deepened to explore the Dakota series and the Geary Dome test will remain idle in the meantime. The Argo Oil Co. has gas in the first Dakota in its test to the Lakota in Lance Creek.

Montana reported a small oil well in the Kevin-Sunburst Field and a small gas well in Hill County.

NEW MEXICO

Hobbs Area—Lea County

Drilling in the Hobbs area is down to two wells, one in the pool and one to the northwest of production, following the completion of the Midwest Refining Co.'s No. 8 Terry and the failure of the National Securities Oil Co.'s No. 1 Linam. The Midwest well in the C NW NW. Section 9-19-38, was given a potential of 3,388 bbls. at a total depth of 4,192 feet. It is an outside well on the southwestern side in the southeastern part of the field. The National Securities Oil Co.'s No. 1 Linam, NE SE SW, Section 33-18-35, 4 miles west of production, was a disappointment after having given encouraging signs. It had 3,500 feet of sulphur water at 4,265-72 feet, the Hobbs producing horizon, and is shut down for orders at 4,272 feet. At 3,845-60 feet it had a show of 4,000,000 feet of gas per day and had oil and gas shows at 4,090, 4,155 and 4,215 feet. The Western Drilling Co.'s No. 1 State, C SW NE, Section 15-18-37, to the northwest of production, has rig completed. The Gypsy Oil Co.'s No. 7 Grimes, SE NE NW, Section 32-18-38, the only well drilling in the Hobbs Pool, set the 9⅝-inch at 2,741 feet and is waiting.

Lovington Area—Lea County

The Western Drilling Co.'s No. 1 State, NE cor. SE, Section 13-17-36, is bottomed at 165 feet and rigging up rotary. This location is 2 miles to the east and a little north of the test drilled in 1929 by the Penn Oil Co. in the NE, Section 21-17-36, which had a show of gas at 4,310 feet and a show of oil at 4,650 feet and was abandoned at 5,775 feet. The Penn well is erroneously carried on some maps as being in a township farther north. The Western Drilling Co.'s No. 1 State, SE NE NE, Section 16-20-32, to the northwest of the Lea Pool, is drilling at 775 feet in the red beds.

Eunice Area—Lea County

The California Co.'s No. 1 Meredith, SE cor. NE, Section 19-21-36, to the west of the Eunice Pool, had a show for 3,700,000 feet of gas at 3,190-3,200 feet. This increased to a total of 12,000,000 feet at 3,241-47 feet. Atlantic Oil Producing Co.'s No. 1 Coleman, SW NE NW, Section 17-21-36, is drilling in lime at 3,842 feet. It had 500 feet of oil in the hole at 3,826-33 feet. This well had a blowout at 3,534 feet last month and was estimated at 50,000,000 feet of gas per day.

Jal Area—Lea County

The Jal area, which has had no active drilling operations in progress for several months, reported a new location this week in Leonard & Levers' No. 1 Justis, C SE NE, Section 19-25-37, two-thirds of a mile east of Continental Oil Co.'s No. 1 Sholes, a gasser.

Eddy County

Flynn, Welch & Yates' No. 59 State, NW cor., Section 5-19-28, Artesia area, is drilling at 1,990 feet.

De Baca County

Matador Oil Co.'s No. 1 Wood, NE SW SW, Section 6-4n-20, Salada Creek, which has been shut down at 3,001 feet for orders since last fall, is reported preparing to resume under a new contract with Brooks E. Miller and John G. Hartman, of Los Angeles, to drill to 4,000 feet. The new interests will incorporate a company and it is reported it will receive a half interest in the block.

Luna County

Angelus Oil & Mining Co.'s No. 3 State, NW SE, Section 20-21-10w, near Deming, is reported drilling below 6,012 feet in sandy shale.

San Juan County

Kutz Canon Oil & Gas Co.'s No. 1 Day, SW cor., Section 20-28-10, Kutz Canon, is drilling at 2,389 feet, and Continental Oil Co.'s No. 24, SW NW, Section 1-29-19, Rattlesnake, is bottomed at 4,730 feet and waiting for fishing tools.

San Miguel County

Con-O-Kul Oil Co.'s No. 1 Stephenson, NW cor. NE, Section 34-17-21, Cherryvale district, is reported drilling at 429 feet in sand topped at 385 feet, believed to be the Wingate in the base of the Jurassic. Cibola Petroleum Co.'s No 1 Larazola, SW cor. NE, Section 9-13-14, Ribera district, is reported shut down at 841 feet.

COLORADO

Eastern Colorado continues to hold the interest of the operators in this territory although the past week has shown no changes of importance. The directors of the Platte Valley Petroleum Co., which brought in the discovery well on the Greasewood Dome in Weld County last October, are scheduled to hold a meeting at Fort Morgan today to act on several matters connected with the development of its properties. One of these is the purchase of a rotary rig for drilling a well in the NW, Section 24-6n-61, on the Johnson tract, just north of the discovery. A. E. Shogren, secretary of the company, has been in Oklahoma inspecting the various types. Another project under consideration is the construction of a pipe line from the discovery well to the railhead at Orchard, either a permanent 6-inch line, or a 4-inch line laid on the surface. It is also planned to drill a 1,100-foot water well for the rotary operation. The company has obligations for drilling four other wells on the Greasewood Dome this year and it is possible that a deal will be made with two of the major companies under which these companies will drill two wells each. Another operation on the Greasewood Dome which is practically assured is the drilling of a well by the Aztec Corp., which will be incorporated next week by Miller Robert Taylor and associates, to take over several blocks which have been acquired. This group is negotiating with a Long Beach, Calif., concern for rotary equipment and expects to begin operations within the next 90 days. The location has not yet been announced, but it is understood to be close in. The plan is to drill down to the Hygiene sand with rotary tools and then to change over to cable tools for a test of that horizon. If the correlation shows that the well is running higher than the discovery well, the hole will be carried on down with rotray bit to test all the sands in the Dakota down to 7,500 feet, if necessary. Another concern has a deal pending which will involve the drilling of three wells, providing it can close up some gaps in the blocks surrounding the three locations.

The county clerk of Weld County recently made a compilation showing that oil leases had been filed for record on 71,160 acres in that county since the Greasewood well was brought in last October. Of this total, 57,360 acres were taken over by major companies including Midwest Refining Co., Ohio Oil Co., Magnolia Petroleum Co., and Texas Production Co. The remainder, 13,800 acres, is held mostly by individuals. This acreage is located in the Greasewood, Briggsdale and Stoneham districts. The figures do not include Morgan and other counties where leasing has taken place on as large a scale. These companies, including the Producers & Refiners Corp. and the Indian Territory Illuminating Oil Co., are among the principal leasers in Morgan and adjacent counties. Several independent Oklahoma concerns also have acquired holdings. The lease play extends down into Washington, Adams and Arapahoe Counties and also farther to the east and southeast.

Refinery Rumors

An interesting report, which has the earmarks of authenticity, came out of Brighton, in Adams County, this week to the effect that the town authorities and officers of the chamber of commerce are negotiating with a major company for the location of a projected refinery in or near that town. The construction of another refinery near Denver will not come as a surprise. Denver is the center of a big marketing territory. Continental Oil Co., in spite of the fact that it has plants at Florence, Colo., and Glenrock, Wyo., recently completed a refinery in Adams County at a cost of close to $1,000,000. The saving in freight rates on refined products was an important factor in the decision to build this plant. The same factor will apply to other marketers in this territory which now ship from Casper or from Oklahoma refineries. Added to this is the incentive to meet the competitive situation growing out of the Continental's action. While the identity of the company conducting these negotiations is not disclosed, two companies are mentioned as being the most likely to undertake such a project. One of these is the Standard Oil Co. of Indiana, through its subsidiary, the Midwest Refining Co., and the other is the Cities Service Co. The last named has no refinery in this territory, though it is in the marketing business, and its subsidiary, the Indian Territory Illuminating Oil Co., is drilling in Morgan County where it has extensive acreage. The Cities Service subsidiaries at present have no production in this territory and if it is the concern conducting the negotiations it is not unlikely that it is taking a precautionary step in the event the Fort Morgan well comes in, or is negotiating for the Platte Valley company's production at Greasewood. However, the matter is in such a position at this time that any discussion is mostly speculative on the basis of the rumors afloat.

MacDeb Drilling Co.'s No. 1 Fitzsim-

(Continued on Page 158)

FOUR WESTERN MICHIGAN WILDCATS HOLD STAGE IN WOLVERINE STATE

By Paul A. Elliott

MUSKEGON, Mich., Mar. 2.—Four western Michigan wildcats, two in Muskegon County, one in Oceana County, and the fourth in Missaukee County, are holding the stage in the Wolverine State. A flow of natural gas said to be good for about 500,000 feet was reported in Henry Miltner's No. 1 Miller and others, NW NE NE, Section 24-24n-7w, Pioneer Township, Missaukee County, near Cadillac. This well is about 100 miles north and east of Muskegon. The gas was reported in the top of the upper Traverse. The three other wildcats are within 25 miles of the Muskegon Field and on an almost straight line northwest at nearly equal intervals of 8 miles each.

Nearest to the field is the new well by W. E. Cooke, in the SE SW, Section 1-11n-17w, Fruitland Township, about 3 or 4 miles northeast of two structure tests drilled in Sections 9 and 15, by the Reed Oil Co.

Operations have been started on H. C. Nelson's No. 1 George T. Rose, SE NE NE, Section 25-12n-18w, White River Township, about a mile west of several wells drilled to the Berea, Traverse and Dundee, respectively, by the White River Oil Corp. Two small Berea wells were pumped for some time on property near Montague village but none has been successful in the Traverse or Dundee. There are indications of a rising structure to the west, it is said.

Edward DuVall's No. 1 Byron Curtis, NE NE, Section 1-14n-19w, Benona Township, Oceana County, about 8 miles north of the White River Township test, is near the shore of Lake Michigan at Little Point Sable.

Four oil or gas producers in the Traverse or Dundee in Muskegon have been plugged. Muskegon Oil Corp.'s No 1 Herman Heinz and No. 2 Albert Heinz, NE NE, Section 8-10n-16w, Muskegon Township; Reed Oil Co.'s No. 4 Torrent estate, SE SW, Section 8-10n-16w, Muskegon Township, and Republic Oil Co.'s No. 2 George S. Brand, SE SE, Section 11-10n-17w, Laketon Township.

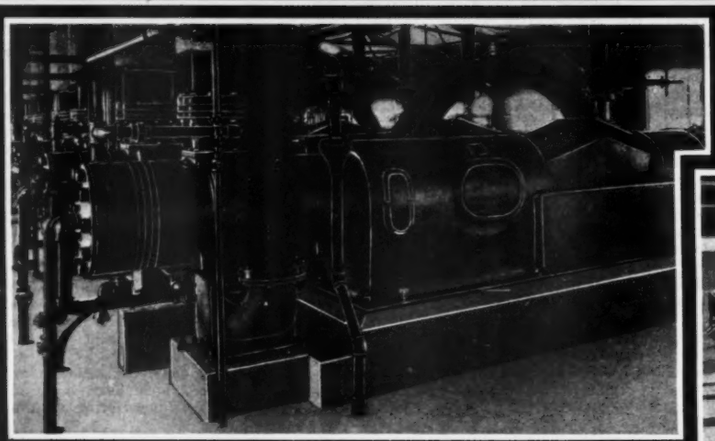
Of the four drilling wells in the Muskegon Field, Lima Oil Corp.'s No. 5 Louis P. Haught, NE SW, Section 9-10n-16w, was cased at 2,172 feet and will be drilled in upon the arrival of Frenk L. Maire, of Lima, Ohio, president. Blue Arrow Petroleum Co.'s No. 1 Laman, SW NE, Section 9-10n-16w, is drilling into the Dundee at about 2,000 feet.

George Talbot's No. 1 Ellen Wiley, NW NE, Section 22-16n-4w, Vernon Township, Isabella County, was the only well to be drilled into the Dundee in Mount Pleasant. Oil was struck about 3,760 feet but the well went into bottom salt water immediately after giving indication it would be good for about 30 bbls. a day at least. An attempt is being made to plug it back.

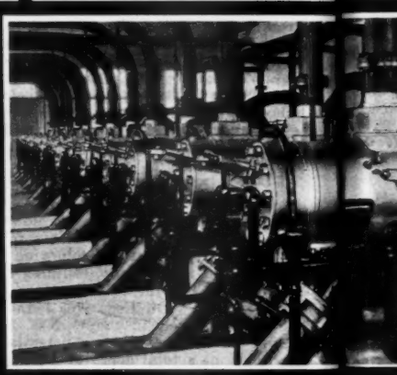
The well is one location north of the Mellon-Pollock Oil Co.'s No. 1 Durnier, NW SW NE, Section 22-16n-4w, which last week was estimated good for 100 bbls. in the Dundee. Production was increased this week to about 130 bbls. at 3,770 feet. These wells are 3 or 4 miles south of the village of Clare.

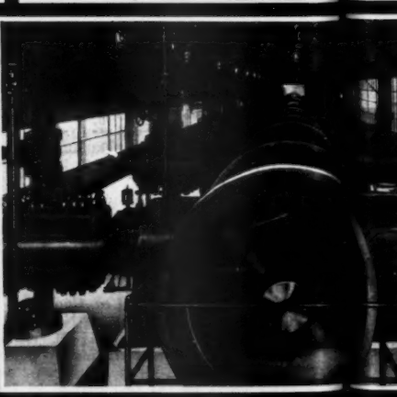
GAS

Efficiently and



(Left) 200 H. P. Super 2s, with new inverted exhaust, at a Kansas refinery.





(Above) 400 H. P. Double Acting CLARK Super 2s in a Louisiana Vapor Recovery Plant

(Right) 100 H. P. Clarks at Rising Star, Texas

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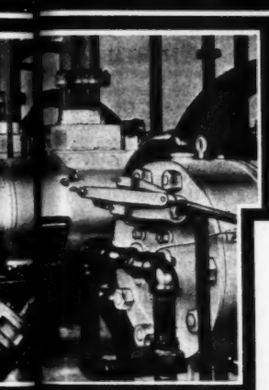
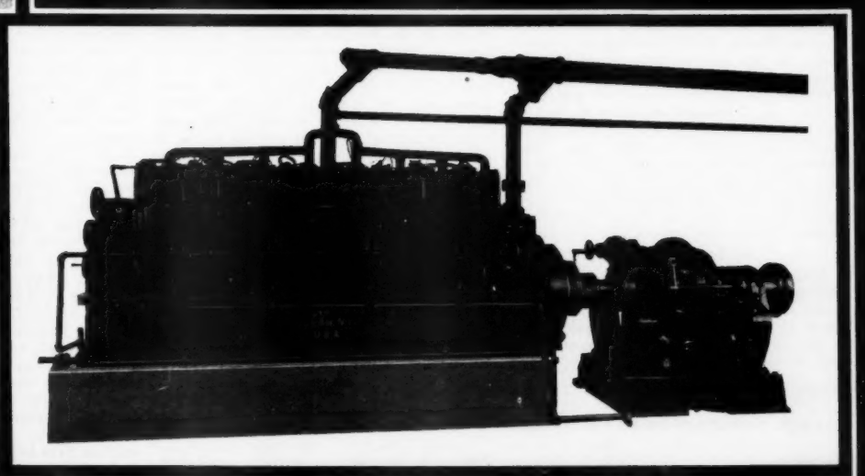


(Left) 200 H. P. CLARK Super 2s in plant at Port Arthur, Texas



(Above) CLARK 8-Cylinder Vertical Gas Engine — an ideal unit for hot oil pump drive or for driving gasoline line pump.

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CLARK

Overproduction Threat in California

Kettleman Hills, Lost Hills-Belridge and Huntington Beach Are Worrying Conservationists on West Coast

By L. P. Stockman
Staff Correspondent, California Fields

LOS ANGELES, Calif., Feb. 28.—The outstanding development in California during the past week was the reduction in gasoline prices posted by the Standard Oil Co. and subsequently met by other majors. This reduction is significant because a drastic price war started about this time last year, during the course of which gasoline sold for as low as 9 and 10 cents per gallon, tax paid. Producers of crude oil were not penalized by a reduction in the price of crude oil commensurate with the drastic reductions which took place in the refined oil market during 1930, but this does not necessarily mean that the existing crude price structure will remain stable irrespective of the prices received for refined products. This is particularly important because some are inclined to believe that crude oil prices are out of line with the refined oil structure.

Increased Production Threatened

A casual survey of the production situation indicates the continuance of excess production of crude oil, despite the settling of production in flush fields and the concerted attempt to curtail production in other areas. Kettleman Hills and the Lost Hills-Belridge Fields are expected to show increased production beginning in March. The Huntington Beach Field of Los Angeles Basin may also occupy a prominent position in the spotlight due to deep zone exploration in the town lot area paralelling the ocean front along the western part of the field. Commercial production has not yet been developed in the new deep zone found by the Superior Oil Co. in the Huntington Beach Field but those familiar with existing conditions look for it in the near future. The Superior Oil Co.'s drilling activities tend to confirm this situation as a second deep test is already down below 5,000 feet. In addition to drilling a second deep well in the town lot area, the Superior is superintending drilling activities on W. E. McCaslin's No. 17 Transport, which is at present rotating ahead at 7,250 feet.

Leasing activities in the town lot section, which is at present being explored for deeper production, have shown a substantial increase during the past 10 days. The Wilshire Oil Co. is the latest entrant into this area and, while it will proceed slowly pending completion of the first successful deep zone producer, the company will assume an aggressive attitude if a production is uncovered sufficiently large enough to justify further drilling. The Wilshire is reconditioning seven small producing wells located in the town lot area preparatory to carrying them down to the projected deep zone discovered by the Superior Oil Co. In addition to this preparatory work, the Wilshire Oil Co. has filed an application with the city council of Huntington Beach for permission to lay two new pipe lines. One of these installations will be an 8-inch and the other a 4-inch. These auxiliary lines will be more in the nature of gathering lines as they will tie in with the company's facilities just outside the city limits.

More Deep Drilling

The Republic Petroleum recently acquired 15 or 20 lots in the older section of the Huntington Beach Field and tentative plans have been completed for the drilling of a deep test within the next 30 or 60 days. This lease has a 90-day drilling clause but drilling operations are expected to get under way long before expiration of the time limit. The Potrero Field of Los Angeles Basin is to be given another chance to develop deep production as the Wilshire Oil Co. has just taken a lease on a portion of the Potrero Gun Club, recently quitclaimed by the Associated Oil Co. after several years of unsuccessful deep zone exploratory work. The leases tied up by the Wilshire comprises 120 acres and, although drilling operations are not required to be started for 60 days, it is thought that material for the first well will be on ground within the next few weeks. This projected drilling is interesting in view of the attempts to develop consistent production in the town lot area located in the northern part of the Potrero Field. Very few wells in the Potrero Field showed any profit from production, while many failed to return even a substantial portion of the amount expended in drilling.

Citizens of Hermosa Beach have petitioned the city council to establish a permanent zone in that municipality in order to restrict drilling operations. The petition to create a residential zone in the area adjacent to the beach and thus preclude drilling operations is due to the drilling of several wells in that area, which geologists and petroleum engineers say is a minor extension of the Torrance Field and not a new independent structure at Hermosa Beach. While commenting on this situation, it might not be amiss to call attention to the fact that a deep test is scheduled to be started southeast of the Torrance Field in the near future. This project will be a joint test drilled by the Olympic Oil & Refining Co. and the York Smullen Oil Co. It will be located in Section 36-4-13 and actual spudding is expected to be done some time within the next three weeks. The Associated's No. 12 DeFrancis, a recent completion in the Dominguez Field of Los Angeles Basin, is still holding up in good shape as far as quantity production is concerned, although the daily output, 1,530 bbls. is cutting about 60 per cent water. No. 7 Manuel of the Shell, a deep test in this field, is still held up with mechanical trouble at 8,922 feet. The Standard added a new well to its list of producers in the Inglewood Field by finishing No. 65 on Los Angeles Investment lease No. 1, pumping 320 bbls. of 18.2 gravity oil per day from 2,700 feet.

An Important Suit

Although it has received but scant consideration, there is a very important suit under way in the court of Superior Judge Leon R. Yankwich in Los Angeles. It is the case of The Texas Company vs. Alta Vedder and Dwight C. Vedder. The Texas Company instituted proceedings to prevent the lessors from cancelling its contract and simultaneously to establish the legal status of the contract in question. The basis of the suit involves whether or not The Texas Company violated the terms of its contract involving acreage in the Mount Poso Field of Kern County, by restricting production in conformity with the statewide curtailment program. The significance which attaches to this case lies in the fact that if an adverse decision is rendered it may jeopardize the status of all other leases on which production has been reduced in the interest of conservation and curtailment. The Texas Company is being represented by William Hazlett, Charles S. Stanley and J. A. Tucker, while the law firm of Pease, Dolley & Ellison represent the defendants.

New Work at Kettleman Hills

There has been a decided increase in activity at Kettleman Hills during the past 10 days due to the starting of several new wells and resumption of work on others. The Kettleman North Dome Association will not become operative until April 1 due to numerous details which must be worked out, although operators at the present time are carrying out the instructions of the association informally. This is indicated by the fact that the Pacific Western Oil Co. and the Milham Exploration Co. are starting two new wells in the western end of the field where the Superior Oil Co. has an exceptionally large producer and several other wells are headed for the deep sand. In addition to the starting of these two new wells, the Milham Exploration Co. is rigging up to resume drilling in No. 1 Kennedy in Section 28-21-17, at 7,373 feet, and the Standard is moving in equipment to resume work in No. 21 fee in Section 33-21-17 at 6,876 feet. The most important development in the North Dome at Kettleman Hills during the week was the logging of the Bentonite in No. 1 Dixon of the Shell at 7,225 feet. This is particularly significant because it indicates the probability that the top of the Temblor will be encountered around 7,275 feet. This well is running considerably higher stratigraphically than many have anticipated and this favorable condition enhances the outlook for production on adjacent properties located still farther away from the theoretical axis.

The starting of new wells by the Pacific Western Oil Co. and the Milham Exploration Co. indicates the possibility that the Kettleman North Dome Association will initiate an aggressive offsetting campaign in the North Dome at Kettleman Hills. This offsetting work will be located as close as possible to wells situated on fee owned acreage outside that covered by the association's agreement. If any considerable amount of offsetting is undertaken, crude oil production at Kettleman Hills may still be the threat which was thought to have been removed by the organization of the Kettleman North Dome Association. Approximately six wells are scheduled to be completed in the North Dome on or before August 1, 1931. It is quite obvious that production of crude oil at Kettleman Hills will exceed normal requirements unless some method is provided to regulate production of individual properties. If the Kettleman North Dome Association proceeds to drill well for well in its offsetting campaign, as prudence dictates, production can be regulated. If on the other hand, however, the association concentrates its drilling activities in some specific area in order to hasten the encroachment of edgewater on fee acreage located outside the association's jurisdiction, crude oil production will be considerably higher than justified.

Lost Hills-Belridge

Developments in the Lost Hills-Belridge Fields of Kern County were decidedly unfavorable during the past week. In the former field the George F. Getty Co.'s No. 1-A Lincoln, drilling in section 12-26-20, came in as a water well from 3,780 feet. Just previous to mudding off the well, the pressure built up to 1,320 pounds. The log of this well indicates the probability that the top of the Temblor was picked up at 3,765 feet. If this is true, the outlook is not any too promising, although a string of 9-inch is being landed preparatory to an early test. In the Belridge district, the Richfield Oil Co.'s No. 1 Belridge, northwest of the deep zone discovery well looks like almost a hopeless job due to the inability to exclude water. This well, located in Section 22-27-20, has all the earmarks of an edge well, especially since a small amount of oil sand was actually encountered during the course of work.

The Ohio Oil Co.'s No. 1 Bloemer, in Section 36-27-20, cored the top of the Temblor at 5,682 feet but proved wet on a test at 5,725 feet. Drilling was continued, however, and the hole will be cored ahead solid. The only favorable news affecting the Lost Hills-Belridge Fields was the announcement that operators in the North Belridge Field had reached a voluntary agreement which provides that no new wells will be started in that field before May 1, by which time it is thought a permanent agreement will be reached. The agreement to refrain from further work in the North Belridge Field was recommended for approval of executive officers by L. C. Decius of the Associated Oil Co., R. E. Collom of the Continental Oil Co., A. C. Rubel of the Union Oil Co., and E. G. Gaylord of the Standard Oil Co.

Playa Del Rey

There was only one producing well finished in the Playa Del Rey Field of Los Angeles Basin during the past week and, while completions will be less frequent in the future, several additional projects are being prepared for early tests. Included in this group are No. 1 Stone of the Pacific Coast Properties, Sovereign Oil Co.'s No. 11 Venice, Seashore Petroleum Co.'s No. 1 Del Rey and the Lubrite Oil Co.'s No. 2 Venice. The Venice Pacific Oil Co.'s No. 2 Del Rey made a short flow during the early part of the week but died a short time later and will require a redrill job as the hole is in bad shape. The new well added during the past week

TANKER SHIPMENTS FROM LOS ANGELES TO ATLANTIC AND GULF COAST PORTS

Commodity—	Total this week	Daily average	Total last week	Daily average	This year to date	Same time last year
Crude oil	.....	.....	.....	.....	.....	77,405
Fuel oil	.....	.....	.....	.....	.....	71,950
Diesel and gas oil	196,794	28,113	.....	.....	606,269	629,315
Gasoline	228,173	32,596	586,082	83,726	2,204,691	2,805,459
Coastwise—						
Crude oil	440,614	62,945	242,305	34,615	2,329,278	2,260,150
Fuel oil	311,650	44,521	246,702	35,100	2,626,444	2,627,839
Diesel and gas oil	16,201	2,314	29,675	4,239	274,255	337,485
Gasoline	315,977	45,140	209,649	29,950	1,709,628	1,540,888
Kerosene	.....	.....	11,053	1,579	63,281	14,043
Exports—						
Crude oil	66,466	9,495	170,153	24,308	1,194,555	1,105,272
Fuel oil	553,775	79,111	431,728	61,675	2,290,857	2,364,257
Diesel and gas oil	78,700	11,243	54,500	7,786	516,830	878,822
Gasoline	76,540	10,934	106,094	16,585	1,480,813	2,289,463
Kerosene	.....	.....	76,918	10,988	174,755	411,229
Lubricants	.....	.....	.....	.....	.....	5,057

TANKER SHIPMENTS FROM SAN FRANCISCO TO ATLANTIC AND GULF COAST PORTS

Diesel and gas oil	.....	.....	.....	.....	.....	88,280
Gasoline	.....	.....	.....	.....	63,975	285,245
Lubricants	.....	.....	.....	.....	11,000	.....
Coastwise—						
Fuel oil	133,077	19,011	.....	.....	516,916	494,484
Diesel and gas oil	5,213	745	.....	.....	5,213	44,546
Gasoline	44,227	6,320	27,127	3,875	379,770	749,563
Kerosene	.....	.....	.....	.....	16,877	91,774
Exports—						
Crude oil	.....	.....	.....	.....	6,010	3,075
Fuel oil	.....	.....	.....	.....	63,610	122,143
Diesel and gas oil	.....	.....	.....	.....	113,156	124,540
Gasoline	85,117	12,160	75,080	10,726	318,272	583,553
Kerosene	.....	.....	95,451	13,636	190,412	133,749

was No. 7 Townsite of the Union Oil Co., which came in flowing 710 bbls. of 23.1 gravity oil per day from 5,921 feet. Immediately upon the completion of this new well, the company spudded No. 9 on the same lease. No. 1 Vidor, located nearly 1 mile east of production, has already passed the 3,000-foot level and should reach the interesting stage in the very near future.

There were several wells put on production in the Long Beach Field during the past seven-day period, although only one of them registered substantial production. This was the Richfield Oil Co.'s No. 6 Bernstein, a new well bottomed at 5,328 feet and finished with an 8⅝-inch water string landed at 5,190 feet, and a 6⅝-inch liner including 130 feet of perforated pipe. This new well registered an initial daily production of 560 bbls. but increased its flow the following day to 980 bbls. The Northwestern Oil Co. listed its No. 1 Signal for completion in the deep zone at 7,700 feet after finishing the hole with a 6⅝-inch liner carrying 1,237 feet of perforated, but the initial daily output, 210 bbls. of 26.3 gravity oil and 300,000 feet of natural gas, was very disappointing. A. H. McFarland finished his No. 2 Cerritos doing 235 bbls. of 23.6 gravity oil per day on the beam from 5,857 feet. The next well listed for completion in the Long Beach Field is E. J. Preston's No. 23 Signal, which is at present standing cemented at 5,242 feet. The liner has already been run in and a test will be concluded shortly.

Ventura Avenue

The Shell Oil Co. increased its list of producers in the Ventura Avenue Field when No. 66 Taylor blew in during the course of a water test flowing 1,040 bbls. of clean 31.2 gravity oil and 1,300,000 feet of natural gas per day from 5,142 feet. The most interesting feature in connection with this new well is the fact that the cement job on the 13⅜-inch water string landed at 4,920 feet was ineffective and had been recemented just previous to the well's flow this week. The Associated must have been conducting a series of experiments on core drilling in its operations at Ventura Avenue during the past week. In No. 104 Lloyd, the company ran a Doheny Stone core barrel at 5,424 feet and a Zublin core barrel at 5,431 feet. On No. 10 McGonigle the company ran an Elliott core barrel at 5,946 feet, while on No. 2 V. L. and W., a Globe core barrel was run at 5,573 feet. A check of development work under way indicates the probable completion of several potential producers in the Ventura Avenue Field during the course of the next several weeks. The Honolulu Consolidated spudded in well No. 2 on tideland permit No. 56 in the Rincon Field of Ventura County during the early part

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SHOWING IN WAITE VALLEY WELL INDICATES POSSIBLE NEW FIELD

By Victor Lauriston
Staff Correspondent, Canadian Fields

CHATHAM, Ontario, Feb. 28.—On the Waite Valley structure west of Turner Valley, Calgary Development & Producing Corp.'s No. 1, LSD 10, Section 21-19-3w5, is drilling 141 feet in the lime at 3,975 feet, nearing the horizon at which some of the Turner Valley wells secured their big naphtha production. Some gas was met at 3,950 feet which increased with deeper drilling, though at last reports there was no large production. Though small, the showing is regarded as a significant indication of the possibility of a new field similar to the Turner Valley.

South Turner Valley

In the South Turner Valley, Commonwealth Petroleum's No. 1, LSD 7, Section 9-19-2w5, has been shot at 5,000 feet, a depth of 388 feet in the lime. Before the shot the well had around 5,000,000 feet of wet gas and preliminary tests indicated a small crude naphtha recovery. It is now testing, with apparently some increase in the gas flow.

East Crest Oil Co.'s No. 3 LSD 4, Section 16-19-2w5, is reported drilling at 2,815 feet and making around 50 feet a day. Boller, Sherman & Boller of Tulsa are handling the contract. The test is logging high and production in the deep lime is looked for at comparatively shallow depth. It is reported that East Crest Oil Co. has contracted to deliver its production to Imperial Oil, Ltd., commencing March 1; the company has production from Nos. 1 and 2-A, the two wells aggregating close to 500 bbls. a day.

Freehold Oil Corp. is starting its No. 4 in LSD 9, Section 28-18-2w5.

Under the terms of an agreement entered into last year between Alberta Pacific Consolidated Oils, Ltd., and Canadian Exploration Co. of Denver, Colo., the former company will located a test on the Brazeau structure as soon as weather conditions this spring permit. The structure is south of Lovett, Alberta, and covers an extensive area in the foothills.

Central Turner Valley

In the Central Turner Valley, British Dominion Oil & Development Corp.'s No. 3, LSD 6, Section 12-20-3w5, got the Madison limestone at 5,202 feet after 10 months' drilling with cable tools. Casing has been cemented at 5,210 feet after bailing considerable light crude that seeped from the upper horizons. New McDougall-Segur Oil Co.'s No. 3, LSD 14, same section, is making new hole below 5,800 feet and close to 400 feet in the lime, and will likely be shot, having developed only a small gas flow. Illinois-Alberta Oils' No. 1, same LSD, will likely be deepened and given a second shot in the lime. Widney Petroleums' No. 1, LSD 11, same section, is 485 feet in the lime at 5,500 feet, and will be carried to 5,600 feet and then shot if it fails to secure satisfactory production. Shareholders of the Widney company held their annual meeting at Calgary recently when the following officers were re-elected: President, Frank Freeze; vice president, O. H. Patrick; directors, J. McKinley Cameron, Emil Sick, William Peterson, John I. McFarland, and R. C. Thomas. The well is reported a fair commercial producer from the lime with considerable light crude still coming from the upper sands.

Structure Oil & Gas' No. 1, LSD 7, Section 31-19-2w5, has been shot at 475 feet in the lime at 5,200 feet and is reported testing around 140 bbls.

In the north end of the field, there is a possibility that Anaconda Oil Co.'s No. 1, LSD 16, Section 22-20-3w5, will resume drilling this spring. The test is in the same section as Model Oils' No. 1, which has developed into a fairly large producer, with around 190 bbls.

Red Coulee Field

In the international Red Coulee Field, Scottish United Petroleums' No. 1, LSD 1, Section 3-1-16w4, on the Alberta end of the structure, bailed between 5 and 6 bbls. an hour on initial production test and has been put on the pump. It is reported No. 2 test will be started shortly. In Section 4-1-16w4, Vanalta Oils' No. 4 has started drilling. This test offsets Vanalta's No. 3, drilled last fall by the Taylor syndicate. Vanalta Oils' Nos. 1 and 2 and Taylor-Vanalta's No. 3 are all in steady production, and account for the major portion of the production in the Alberta end, which in December aggregated 6,357 bbls.

On the Montana end of the structure, Monalta Oil Co.'s No. 2 Buckley, Section 1-37-4w, which some weeks ago came into production after being abandoned as a dry hole, is reported to have shown 150 bbls. in eight hours on a production test, and is being cleaned and put on the pump.

Border Fields

In the Border areas of southern Al-

(Continued on Page 183)

IMPORTANT NORTHERN CALIFORNIA WILDCATS

Company, well and location—	S-T-R	Depth	Status
Western Gulf, No. 1 Santa Maria, Santa Barbara Co.	5- 9-33	5,596	br. sh. drilling
Fields Gas Co., No. 1 Santa Maria, Santa Barbara Co.	8- 9-33	5,570	suspended
Barnsdall, No. 1 Gato Ridge, Santa Barbara Co.	9- 8-32	6,050	fishing
Midwest Oil Co., No. 1 Los Alamos, Santa Barbara Co.	2- 7-33	1,800	suspended
General Pet., No. 1 Goleta, Santa Barbara Co.	21- 4-28	4,533	gas—shut in
General Pet., No. 2 Goleta, Santa Barbara Co.	21- 4-28	4,350	gas—shut in
General Pet., No. 3 Goleta, Santa Barbara Co.	21- 4-28	4,540	will plug
General Pet., No. 134 Goleta, Santa Barbara Co.	21- 4-28	1,485	suspended
General Pet., No. 136 Goleta, Santa Barbara Co.	21- 4-28	1,302	br. sh. drilling
General Pet., No. 137 Goleta, Santa Barbara Co.	21- 4-28	2,050	validation OK
General Pet., No. 138 Goleta, Santa Barbara Co.	21- 4-28	4,931	suspended
General Pet., No. 139 Goleta, Santa Barbara Co.	21- 4-28	2,051	validation OK
General Pet., No. 143 Goleta, Santa Barbara Co.	21- 4-28	1,040	suspended
Boles Oil Co., No. 140 Goleta, Santa Barbara Co.	22- 4-28	1,040	suspended
U. S. Pet., No. 141 Goleta, Santa Barbara Co.	20- 4-28	1,035	suspended
U. S. Pet., No. 142 Goleta, Santa Barbara Co.	20- 4-28	1,032	suspended
U. S. Pet., No. 143 Goleta, Santa Barbara Co.	20- 4-28	1,019	suspended
El Camino, No. 149 Goleta Tideland, Santa Barbara Co.	22- 4-28	1,035	suspended
Bolsa Chica, No. 191 Goleta, Santa Barbara Co.	24- 4-29	4,191	recemented
Caldwell Brown, No. 159 Goleta, Santa Barbara Co.	24- 4-29	1,040	suspended
Johnson, George, No. 1 Goleta, Santa Barbara Co.	X- 4-28	4,089	suspended
Prairie Oil Co., No. 1 Capitan, Santa Barbara Co.	32- 5-30	3,155	gr. sd. drilling
Cuyama Oil Corp., No. 1 Cuyama, Santa Barbara Co.	12-10-27	rig	suspended
Hart Pet. Co., No. 1 Cuyama, Santa Barbara Co.	27-10-26	....	material
Wildcat Oil Co., No. 1 Santa Maria, Santa Barbara Co.	20-10-35	5,500	suspended
Pacific Western, No. 1 Gibraltar, Santa Barbara Co.	14- 5-27	2,345	suspended
Prairie Oil & Gas Co., No. 1 Ventura, Ventura Co.	30- 3-22	8,770	sd. sh. drilling
Associated, No. 1 Rincon Creek, Ventura Co.	19- 4-24	2,080	suspended
C. C. M. O. Co., No. 2-A Rincon, Ventura Co.	23- 3-24	8,375	br. sh. drilling
Continental, No. 1 Rincon, Ventura Co.	23- 3-24	917	sd. sh. drilling
Associated, No. 1 Fillmore, Ventura Co.	16- 4-20	....	grading
Pure Oil Co., No. 1 S. P. Canyon, Ventura Co.	15- 4-21	2,591	suspended
Superior Oil Co., No. 1 Sespe, Ventura Co.	14- 4-21	5,580	sd. sh. drilling
Lockwood Valley Oil Co., Well No. 1, Ventura Co.	32- 8-21	1,015	suspended
Magu Synd., No. 1 Oxnard, Ventura Co.	.....	mtl.	building rig
Wilshire Oil Co., No. 1-A Buttonwillow, Kern Co.	7-29-24	6,590	cleaning out
Kent & McDonald, No. 1 Temblor Hills, Kern Co.	3-32-22	1,672	suspended
Federal Drlg. Co., No. 1 Buena Vista, Kern Co.	20-31-24	5,248	testing
General Pet., No. 1 Belridge, Kern Co.	30-28-21	3,605	fishing
The Texas Company, No. 1 Belridge, Kern Co.	22-27-20	4,628	sd. sh. drilling
Richfield, No. 1 Belridge, Kern Co.	20-27-20	6,639	salt water
Standard, No. 2 Belridge, Kern Co.	31-27-20	4,745	sd. sh. drilling
Ohio Oil Co., No. 1 Belridge, Kern Co.	36-27-20	5,775	gr. sd. drilling
Reward Oil Co., No. 1 Belridge, Kern Co.	34-27-20	3,962	sd. sh. drilling
Union, No. 17 Belridge, Kern Co.	36-27-20	4,980	test WSO
Continental, No. 1 Belridge, Kern Co.	36-27-20	mtl.	building rig
Union, No. 1 Bacon-Belridge, Kern Co.	21-28-20	2,150	abandoned
Casa Mira Oil Co., No. 1 Belridge, Kern Co.	29-28-20	rig	suspended
Tom Cannon, No. 1 Belridge, Kern Co.	18-28-22	rig	suspended
Wallace, K. C., No. 1 Belridge, Kern Co.	32-29-21	4,200	sd. sh. drilling
Rio Cal. Pet., No. 1 Shale, Kern Co.	2-27-18	2,355	suspended
Wicker, Sy, No. 1 Arvin, Kern Co.	12-30-28	1,250	suspended
Shell, No. 1 Weed Patch, Kern Co.	29-30-29	7,418	hd. sd. drilling
Shell, No. 2 Weed Patch, Kern Co.	29-30-29	5,560	redrilling
Shell, No. 3 Weed Patch, Kern Co.	32-30-29	3,040	sd. sh. drilling
Mohawk Oil Co., No. 1 Weed Patch, Kern Co.	32-30-29	5,966	recemented
Mohawk Oil Co., No. 2 Weed Patch, Kern Co.	4-31-29	mtl.	building rig
Alpine Oil Co., No. 1 Weed Patch, Kern Co.	13-31-29	mtl.	building rig
Standard, No. 1 Devils Den, Kern Co.	14-25-18	2,060	br. sh. drilling
Hannon, Tom, No. 1 Devils Den, Kings Co.	25-25-18	2,650	sd. sh. drilling
Shell, No. 1 Semitropic, Kern Co.	17-27-23	9,700	set 5⅜-inch
Cities Service, No. 2 Wasco, Kern Co.	16-28-24	180	core hole
C. C. M. O. Co., No. 1 Jasmine, Kern Co.	33-28-25	1,741	hd. sd. drilling
Moran & DeCamp, No. 1 Mojave, Kern Co.	36-10-14	750	suspended
Meridan Oil Co., No. 1 Antelope, Kern Co.	11- 9-15	3,804	suspended
Ritchie, J. J., No. 1 Tejon, Kern Co.	33-11-19	5,530	suspended
Associated, No. 1 Jacalitos, Fresno Co.	22-21-15	3,950	reaming
Carruthers Oil Co., No. 1 Fresno, Fresno Co.	4-17-20	rig	suspended
Miracle Oil Co., No. 1 Cuyama, San Luis Obispo Co.	17-10-25	314	suspended
Panorama Oil Co., Well No. 1, San Luis Obispo Co.	7-31-21	4,019	suspended
Latin Amer. Pet., No. 1 Shandon, San Luis Obispo Co.	21-27-15	4,525	suspended
Continental, No. 1 San Miguel, San Luis Obispo Co.	26-25-11	4,591	hd. sd. drilling
Schilling, C., No. 1 Atascadero, San Luis Obispo Co.	24-28-12	916	suspended
Martin, J. D., No. 1 Edna, San Luis Obispo Co.	5-31-13	3,010	suspended
Schockley, C., No. 1 Pismo, San Luis Obispo Co.	13-32-13	2,530	suspended
Pacific Inland, Well No. 1, Monterey Co.	19-23-15	1,075	hd. sd. drilling
Brown, F. A., No. 1 Parkfield, Monterey Co.	15-23-14	816	suspended
O'Donnell, J. E., No. 1 Dudley Ridge, Kings Co.	7-23-20	1,635	gas well—idle
Murphy Oil Co., No. 1 Dudley Ridge, Kings Co.	20-23-20	3,700	sd. sh. drilling
Kettleman Lakeview, No. 1 Tulare Lake, Kings Co.	11-23-19	1,304	cleaning out
Furman, T. H., No. 1 Reef Ridge, Kings Co.	36-23-17	2,574	suspended
Seymour, L. W., No. 1 Avenal, Kings Co.	10-23-16	1,148	suspended
Twin State Oil Co., No. 1 Point Arena, Mendocino Co.	14-12-17	6,075	hd. sd. drilling
Orinda Pet., Well No. 1, Contra Costa Co.	32- 1- 3	1,405	hd. sd. drilling
Pettingall, C. F., No. 1 Porterville, Tulare Co.	15-22-27	mtl.	building rig
Inland Valley Oil Co., No. 1 Visalia, Tulare Co.	24-17-24	2,192	cleaning out
Colusa Oil Co., No. 1 Bush, Colusa Co.	31-15- 4	840	hd. sd. drilling
Oakdale Oil Co., No. 1 Oakdale, Stanislaus Co.	3- 2-10	4,100	hd. sd. drilling
Orland Oil Synd., No. 1 Orland, Tehama Co.	31-23- 3	2,355	sd. sh. drilling

IMPORTANT SOUTHERN CALIFORNIA WILDCATS

Olympic Realty Corp., No. 1 Barnes, Los Angeles Co.	14- 2-15	4,875	cleaning out
Hines Pet., No. 1 Ocean Park, Los Angeles Co.	9- 2-15	1,200	set pipe
Taylor Oil Co., No. 1 Culver, Los Angeles Co.	12- 2-16	5,860	sd. sh. drilling
Mesmer City Corp., No. 1 Mesmer, Los Angeles Co.	24- 2-15	150	suspended
Dwyer & Becker, No. 1 Compton, Los Angeles Co.	17- 3-13	4,520	wet
Allison Synd., No. 1 Baldwin, Los Angeles Co.	8- 2-14	5,110	recemented
Cal. Ventura Oil Co., No. 1 Manhattan, Los Angeles Co.	30- 3-14	6,525	suspended
Cal. Ventura Oil Co., No. 1 Hermosa, Los Angeles Co.	31- 3-14	3,396	suspended
Cal. Ventura Oil Co., No. 2 Hermosa, Los Angeles Co.	31- 3-14	3,300	testing
Cal. Oilfields Corp., No. 1 Hermosa, Los Angeles Co.	31- 3-14	1,316	cemented
Corniel Oil Corp., No. 1 Hermosa, Los Angeles Co.	31- 3-14	1,950	sd. sh. drilling
Westwood Pet., No. 1 Hermosa, Los Angeles Co.	6- 4-14	rig	suspended
Tulsa Oil Co., No. 1 Hermosa, Los Angeles Co.	6- 4-14	rig	suspended
Wood, C. L., No. 1 Hawthorne, Los Angeles Co.	10- 3-14	2,184	suspended
McMahon & McDonald, No. 1 Watts, Los Angeles Co.	12- 3-14	4,665	suspended
Staple Oil Co., No. 1 Manhattan, Los Angeles Co.	24- 3-15	740	suspended
Shelley, C. M., No. 1 Torrance, Los Angeles Co.	12- 4-14	rig	suspended
Mack Oil Co., No. 1 Chatsworth, Los Angeles Co.	6- 2-16	rig	suspended
San-Van Oil Co., No. 1 Van Nuys, Los Angeles Co.	14- 1-16	2,124	recemented
Rucker & Croul, No. 2 Puente, Los Angeles Co.	27- 2-10	1,873	sd. sh. drilling
Arden Oil Co., No. 1 Puente, Los Angeles Co.	15- 2-10	3,325	suspended
D. & B. Oil Co., No. 1 Puente, Los Angeles Co.	3- 2-10	4,620	suspended
El Dorado Oil Co., No. 1 Puente, Los Angeles Co.	30- 2- 9	1,092	suspended
Marcel Pet. Co., No. 1 Puente, Los Angeles Co.	31- 2- 8	3,100	suspended
Cudahy Oil Co., No. 1 Bell, Los Angeles Co.	30- 2-12	1,030	testing WSO
The Texas Company, No. 1 Montebello, Los Angeles Co.	4- 2-12	2,070	sd. sh. drilling
Celito Oil Co., No. 1 Monterey Park, Los Angeles Co.	28- 1-12	5,278	suspended
Hammer, Fred, No. 1 Alhambra, Los Angeles Co.	24- 1-13	3,412	hd. sd. drilling
Los Gatos Oil Co., No. 1 El Monte, Los Angeles Co.	16- 1-11	2,280	suspended
Rancho Oil Co., No. 1 Rosemead, Los Angeles Co.	30- 1-11	3,930	sd. sh. drilling
Olympic Corp., No. 1 Calabasas, Los Angeles Co.	18- 1-17	5,695	prod. test
Nesa Pet., No. 1 Newport, Orange Co.	21- 6-10	4,910	suspended
Hall, H. L., No. 1 Newport, Orange Co.	20- 6-10	790	suspended
Gosell, T. F., No. 1 Newport, Orange Co.	29- 6-10	1,000	sd. sh. drilling
Standard, No. 1 Newport, Orange Co.	26- 6-10	3,750	hd. sd. drilling
Borderland Oil Co., No. 1 Encinitas, San Diego Co.	12-13- 4	2,519	suspended
Borderland Oil Co., No. 1 Point Loma, San Diego Co.	30-16- 3	4,175	suspended
Carr, O. K., No. 1 Capistrano, San Diego Co.	13- 8- 8	5,250	cleaning out
Grey, H. H., No. 1 Redlands, San Bernardino Co.	25- 1- 2	2,392	suspended
Western Gulf, No. 1 Santa Ana, Orange Co.	12- 3- 8	2,366	cemented
The Texas Company, No. 1 Olive, Orange Co.	7- 4- 9	3,010	sd. sh. drilling

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Axelson Sucker Rods have won the distinction of giving uniformly satisfactory service, free from rod fatigue or pin fracture. This reputation has been built because all rods in an Axelson string are identical in every fractional portion of their area. Because they are alike they resist at every point the stresses and strains of pumping service. Their uniformity is the result of thorough and scientific laboratory control. Tested for hardness with Brinell instruments... for ultimate strength, yield point, percentage of elongation and reduction of area by Olsen tensile testing machine, laboratory record has only started. Olsen-Izod tested to ascertain the ability of the rod material to withstand shock or impact stresses, Tinius-Olsen fatigue tested for endurance limit, specimen bar after specimen bar from each heat is studied and the results recorded.

Physical tests are completed by subjecting rod specimens to hot acid immersion, in this way determining any seams or pipes in the material. Chemical analysis determines the correct proportions of ingredients which combine in forming a high-grade steel. To the physical and chemical analysis of material is added a minute inspection of forgings, threads, rod shoulders, in fact thirty-one inspections are made on various portions of the rod before it is ready for field service.

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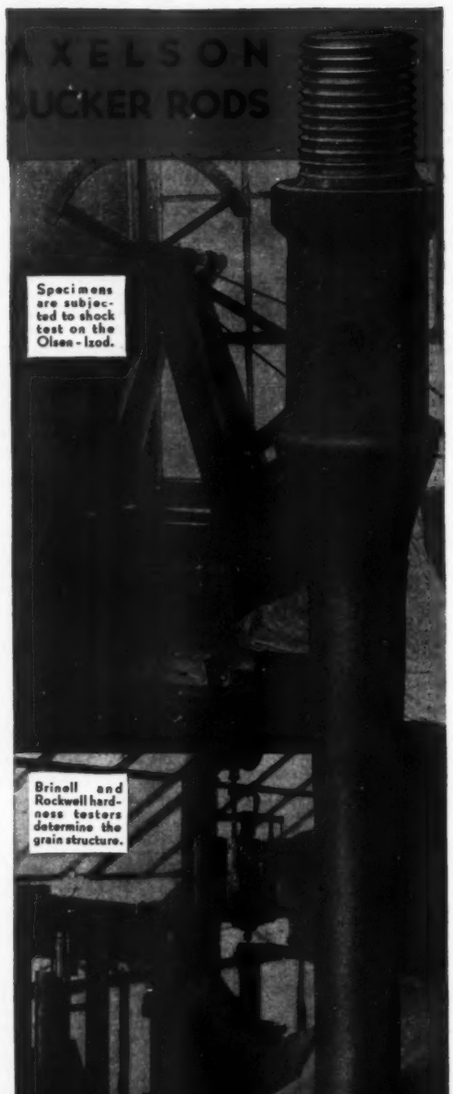
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SUCKER RODS
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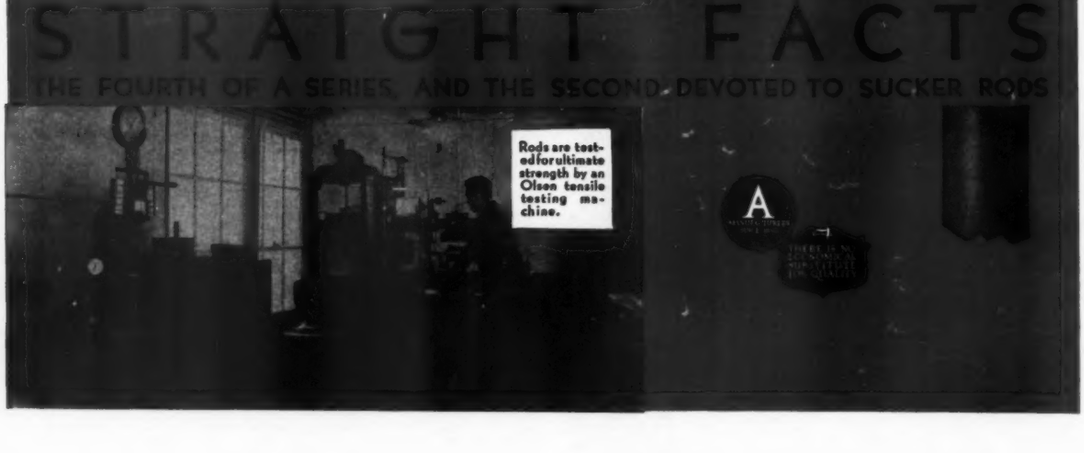
Brinell and Rockwell hardness testers determine the grain structure.

STRAIGHT FACTS
THE FOURTH OF A SERIES, AND THE SECOND DEVOTED TO SUCKER RODS



Field Problems and Their Solution

EDITED BY THOMAS F. SMILEY

In order that men connected with the drilling, producing and transporting branches of the petroleum industry may procure quickly a solution of many problems confronting them from time to time in their work, The Oil and Gas Journal has arranged with leading engineers and other recognized authorities to answer questions submitted by readers of this publication pertaining to the work of drilling and producing crude oil and transporting this product.

Everyone is invited to submit questions freely. These questions will be submitted to proper authorities by Mr. Smiley, who edits the page, and answers, based on the best available information, will be published. Each question should give as much detail as possible, especially where it relates to matters where depths of sands, types of sands and operations on adjoining properties would have a bearing on the problem involved. The source of all questions will be considered as confidential and only initials will be published in connection with the question.

In this connection, The Oil and Gas Journal will be glad to publish articles from field men who have devised new methods or practices which are improvements.

In case an immediate answer is important, one will be given by mail if the writer requests it.

WHAT IF THE DRILL KEPT ON?

What would be found if the oil well driller kept right on drilling? Of course I know it would be a mechanical impossibility for him to keep on indefinitely, but I would like to know whether the scientists have been able to find out much about the inside of the earth beyond the depth that the drills have penetrated. This may not be a practical field question, but it seems interesting just the same. Another thing, if the scientist has obtained any facts along this line, how did he get them?—E. F. D.

Much of the mystery that surrounded the subject of the earth's interior has been removed in the last 10 years, with the result that it is possible to form a fairly satisfactory picture of what the oil well driller would find if he could keep on drilling.

The most fruitful source of information, according to the Research Foundation, Inc., an organization of engineers in various fields, has been data obtained by seismologists, especially when combined with the results of laboratory measurements on rocks and minerals. Earthquakes produce elastic waves, some of which travel along the surface while others pass through the body of the earth and may be recorded by a seismograph anywhere on the globe.

These waves, emerging at a given station, bear with them a message telling how long they have been on the way, how deep they have penetrated into the earth, and exactly how fast has been their speed at all points of their path. These messages by ingenious mathematical analysis may be deciphered. Of particular interest is the conclusion that near the surface the velocity of one type of throughwaves (the longitudinal ones) is 3.3 miles per second, and that at about 30 miles depth the velocity suddenly changes to 6.4 miles per second.

With this aid from the seismologist and the mathematician the physicist provides measurements on the elastic properties of typical rocks and minerals. These measuremens are obtained with a high-pressure apparatus capable of developing 12,000 atmospheres hydrostatic pressure, and are of importance because from the elastic constants it is possible to calculate the velocity with which longitudinal vibrations will pass through the several kinds of rock. By comparing these results with the known velocities at various depths as determined from seismologic data and noting which velocities match, the scientist is able to determine the kind of rock which exists at any given depth. In this way it is found, for example, that the outermost 10 miles consists almost entirely of granite.

Turning now to another line of evidence, something of the nature of the very center itself, is ascertained. It has long been known that the average density of the earth is 5.5; (that is, its materials have an average weight five and a half times that of water). Since the density of surface rocks is about 2.7 (that is, they weigh 165 pounds a cubic foot), it follows that somewhere within the earth there must be some heavier material. Indeed, to make the average come out right, it would be expected that at the center the density would be 8 or 10. This high density may be caused either (1) by the diminution in volume of ordinary rocks under the enormous pressures in the interior (3,000,000 atmospheres at the center) or (2) by the presence of some intrinsically heavier material. The first of these possibilities has been ruled out by a careful investigation; therefore it is concluded that there is a central core of some heavy substance which from its abundance in the sun and stars and in meteorites, is almost centainly iron.

Ignoring the relatively thin layer of sedimentary rocks at the surface, there is first a layer of granite 10 miles thick; below that a layer of basaltic rocks 20 miles thick; then 2,000 miles of peridotite, a rock rare at the surface, consisting of iron magnesium silicate; and finally a central core 4,000 miles in diameter of metallic ore with a little nickel.

Perhaps the most striking feature of the earth's composition is that it consists almost entirely of four elements, iron, magnesium, silicon and oxygen. The 88 possible other elements are confined to the thin film called the crust.

EXPLORING BY ELECTRICITY

In the February 17, 1931, issue of the Denver Post there was an article headed, "Electric Wires Laid on Ground Give Depth of Bed Rock Below Surface." This method of exploration was described to the American Institute of Mining and Metallurgical Engineers at its February meeting in New York by E. G. Leonardon. Experiments were mentioned as being conducted along the St. Lawrence River in British Columbia and Quebec. If the A.I.M.E. will publish this article, please tell me how I may obtain a copy.—F. M. J.

In the February 6, 1929, issue of The Oil and Gas Journal the article on "Electric Coring," by L. G. E. Bignell, described this method which was developed by two French engineers, Conrad and Marcel Schlumberger. It describes the method in detail.

It may be that you can get additional information on this subject by writing to E. G. Leonardon, Schlumberger Electrical Prospecting Methods, 25 Broadway, New York. Mr. Leonardon's article presented before the A.I.M.E. annual meeting in New York is known as Technical Paper 407, and copy of it can be obtained by writing to the American Institute of Mining Engineers, 29 West Thirty-ninth Street, New York.

MIGRATORY CHARACTER OF OIL

Oil often is referred to as a migratory substance. Is there unanimity of opinion about this? Also does this description of oil in the ground mean that it moves about before any wells are drilled or does it mean that when you begin to draw oil out of the sand the place previously occupied by oil taken to the surface is filled by oil farther back in the sand and driven toward the hole by gas or other forces? The question particularly in my mind is this: If oil really is a migratory substance, how is its ownership legally determined?—S. O. D.

Under normal conditions it seems safe to assume that there is no movement of gas, oil or water in a structure until such time as the underground reservoir is tapped with wells drilled into it.

One of the reasons such an assumption seems safe to make is that it required natural forces a long period of time to accumulate oil and gas in underground reservoirs and when so accumulated these elements were in a state of natural balance so far as energy contained in them is concerned and would not move again unless some external force disturbed them.

It is possible to drain old underground reservoirs of their hydrocarbon contents by earth movements such as those brought abbut by earthquakes or faulting in the upper strata of the earth's crust, but such conditions would not justify us in calling these contents migratory in the sense implied by your question.

WHY WAS IT CALLED THAT?

NOSE SILL

This combination of two familiar words, "nose" and "sill," is used to designate a foundation timber, or rock, placed at the front (or nose) of a structure. It is supposed the term as used in the oil field was borrowed from the sea, for the prow or bow of a ship is referred to by sailors as its nose, and the timber forming the foundation for this part of the hull would be the nose sill. The corresponding member in the foundation of an oil derrick soon came to be known by the same designation.

In natural reservoirs for oil and gas it has been quite definitely proven that the gas is compressed into very small areas and in such a state represents stored energy that will be released only when external forces change the underground conditions, such as entering the formation with a drill and tapping the structure.

When such a condition has been brought about the gas will tend to escape through the well and in so doing it will carry the oil before it and in this way the reservoir is drained of its gaseous and fluid content.

As the pore spaces in the formation are drained of their content it is assumed that other fluids or gases will enter to establish equilibrium so the fluids contained in the reservoir are moved toward the point of exit in what might be termed a series of succeeding waves that are controlled by the forces set up by the expanding gases and the energy obtained from the hydrostatic pressure of waters that surround the oil and exert a force upon it.

There have been repeated court decisions to the effect that ownership of the soil carries with it ownership of the gas and oil beneath its surface. The United States Supreme Court has upheld court decisions that the owner of the land has only a qualified right to the gas and oil under it and to exclude all others from exercising the right to recover and possess these substances. Title to the oil and gas does not vest in the owner of the land until he actually has reduced it to possession by bringing it into a well or pipe line, or in the case of oil, into a tank or other receptacle. It is recognized that until this has occurred the gas or oil may escape from beneath his land, be recovered by another person and become the latter's property.

The Supreme Court of the United States used the following language in one case:

"If the analogy between animals ferae naturae and mineral deposits of oil and gas, stated by the Pennsylvania court and adopted by the Indiana court, instead of simply establishing a similarity of relation, proved the identity of the two things, there would be an end of the case. This follows because things which are ferae naturae belong to the 'negative community'; in other words, are public things subject to the absolute control of the State, which, although it allows them to be reduced to possession, may at its will not only regulate but wholly forbid their future taking. But whilst there is an analogy between animals ferae naturae and the moving deposits of oil and natural gas, there is not identity between them. Thus, the owner of land has the exclusive right on his property to reduce the game there found to possession, just as the owner of the soil has the exclusive right to reduce to possession the deposits of natural gas and oil found beneath the surface of his land. The owner of the soil cannot follow game when it passes from his property; so, also, the owner may not follow the natural gas when it shifts from beneath his own to the property of some one else within the gas field. It being true as to both animals ferae naturae and gas and oil, therefore, that whilst the right to appropriate and become the owner exists, proprietorship does not take place until the particular subjects of the right become property by being reduced to actual possession. The identity, however, is for many reasons wanting. In things ferae naturae all are endowed with the power of seeking to reduce a portion of the public property to the domain of private ownership by reducing them to possession. In the case of natural gas and oil no such right exists in the public. It is vested only in the owners in fee of the surface of the earth within the area of the gas field."

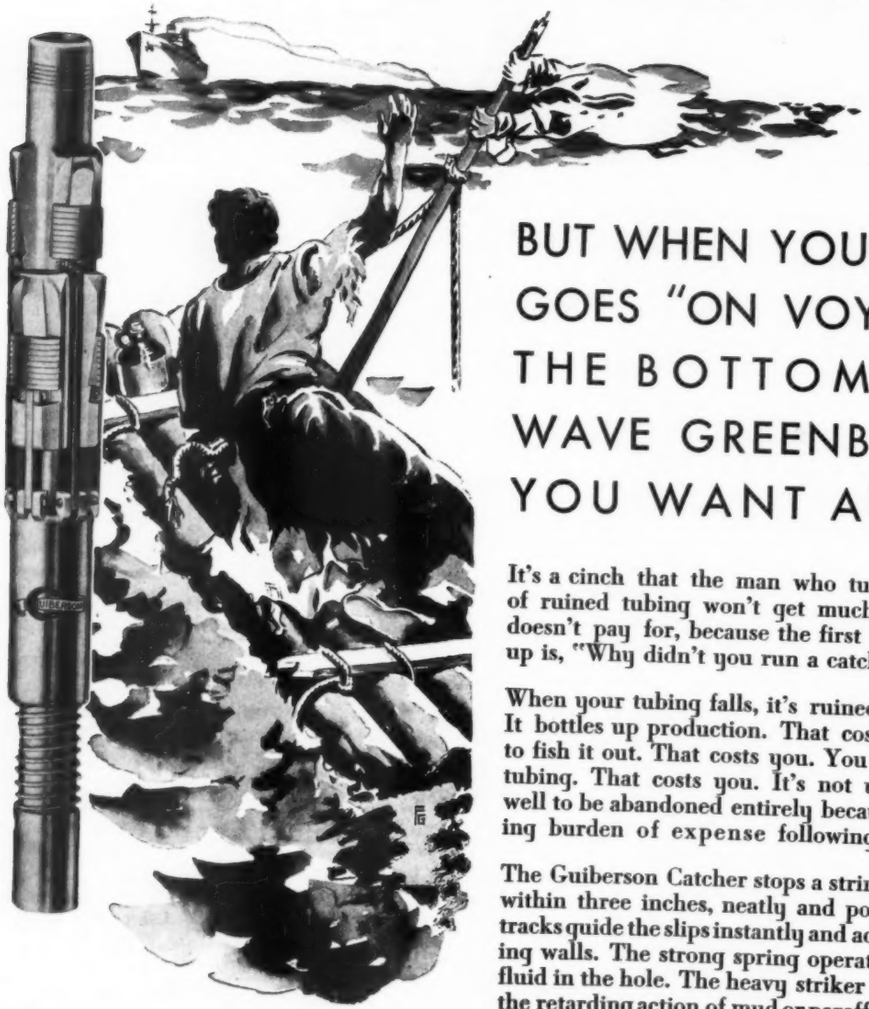
OUTAGE TABLES FOR TANK CARS

Would you please print an outage table for use with tank cars, such a one as will be close enough for practical purposes?—G. E. G.

Owing to the fact that the rated capacity of a tank-car barrel differs widely from its actual capacity in many cases and the further fact that even the capacity of an individual tank car may undergo changes, it is impractical to use any outage table other than one prepared by the manufacturer of the car or by the refiner or marketer owning it. In most cases such tables are available for traffic departments, and by getting in touch with the owner of a car or cars you probably could obtain the information you want.

A car with a rated capacity of 8,000 gallons may actually hold 8,016, 8,048, 8,165 or some other odd number of gallons. Also the capacity of a given car varies slightly while it is in use and it is necessary to have check tests run from time to time. These variations in capacity may result from corrosion, repairs or other causes.

YOU CAN STOP A SHIP WITH A WHITE RAG



BUT WHEN YOUR TUBING GOES "ON VOYAGE" TO THE BOTTOM — YOU WAVE GREENBACKS IF YOU WANT ANY HELP

It's a cinch that the man who turns up with a mess of ruined tubing won't get much sympathy that he doesn't pay for, because the first thought that pops up is, "Why didn't you run a catcher?"

When your tubing falls, it's ruined. That costs you. It bottles up production. That costs you. You have to fish it out. That costs you. You have to buy more tubing. That costs you. It's not unusual for a nice well to be abandoned entirely because of the smothering burden of expense following such a disaster.

The Guiberson Catcher stops a string of falling tubing within three inches, neatly and positively. Dove-tail tracks guide the slips instantly and accurately to the casing walls. The strong spring operates with or without fluid in the hole. The heavy striker weight overcomes the retarding action of mud or paraffin. Doesn't it seem sensible to use a Guiberson Catcher at all times, when it costs hardly one iota of the above expense or the value of your well?

NEW DUPLEX CATCHER

Developed to meet safety requirements of tubing in deep wells. Multiple slips, actuated by a common means. Information on request. *Fully patented.*

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THE GUIBERSON CORP.
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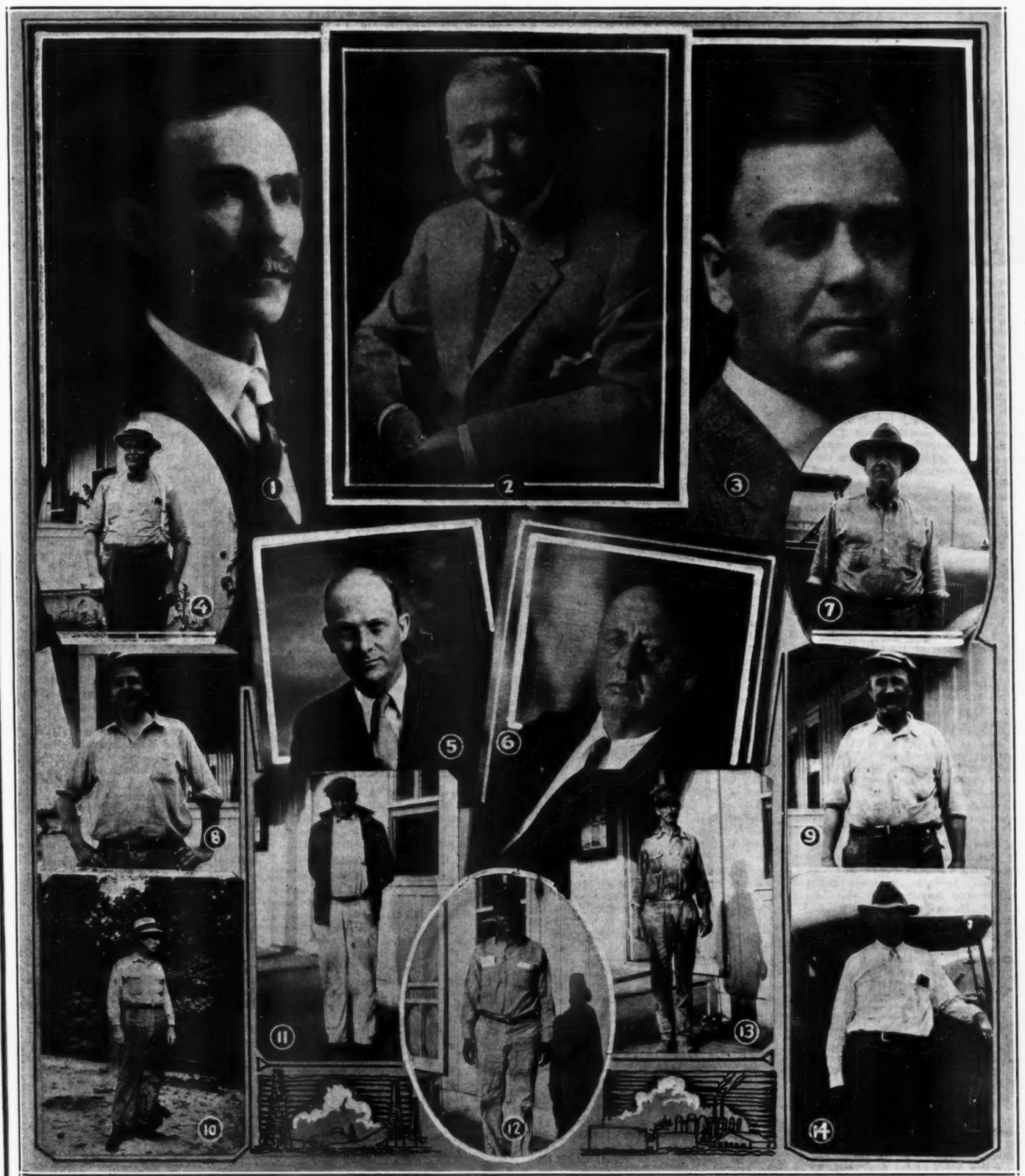
Use a GUIBERSON CATCHER

GUIBERSON

BETTER BE SAFE THAN SORRY

Oil Men Active in the Industry in the Eastern Fields



The following men are largely responsible for the operations of the Petroleum Exploration Company of Sistersville, W. Va.: 1—G. W. Francis, scout and leaser, Owensboro, Ky. 2—E. A. Durham, president, Sistersville, W. Va. 3—L. E. Gregg, secretary, Sistersville, W. Va. 4—A. H. Wagner, general superintendent, Lexington, Ky. 5—Earl D. Wallace, manager, land office, Lexington, Ky. 6—J. T. Osborne, pumper, Woodsbend, Ky. 7—Dan Price, district superintendent, Winchester, Ky. 8—Paul Landrus, assistant general superintendent, Lexington, Ky. 9—D. E. Clinton, construction superintendent, Leeco, Ky. 10—J. B. McMillion, district foreman, Beattyville, Ky. 11—William McCroskey, district foreman, Leeco, Ky. 12—Ralph McKee, district foreman, Leeco, Ky. 13—Lee Lewis, district foreman, Leeco, Ky. 14—Tom Crouch, district foreman, Irvine, Ky.

Thirteen Completions in Central Ohio

Two Producers Made but 11 Bbls. Many Old Wells Abandoned in the Lima Field. Two Completions in Indiana

By George A. Whitney
Staff Correspondent, Central West Fields

FINDLAY, Ohio, Mar. 2.—In the old Lima Field of northwestern Ohio, a large number of old wells that have been producing for many years were abandoned. In Seneca County, known as the Tiffin Field, a number of concerns are drilling for gas and while the volume is usually rather small, they are utilized for heating purposes in that county. In Liberty Township, of this county, the Sandusky Gas Co. has brought in four gas wells. No. 2 on the Eli Rosenberger farm, Section 25, showed a volume of 10,000 feet, and No. 3, same farm, 20,000 feet; while No. 2 on the Schlachter & Fleck farm, Section 24, same township, produced 15,000 feet, and No. 3 showed 30,000 feet, with No. 4 drilling. Same company is drilling No. 3 H. Wright farm, same section. Industrial Gas Co.'s No. 3 Edward Stahl farm, Section 33, same township, produced only 2,000 feet. In Scipo Township, same county, the Honey Creek Oil Co.'s No. 1 on the Gilbert Berton farm, is reported good for 5 bbls. This well topped the Trenton at 2,001 feet, showing of oil at 2,305 feet and went to a total of 2,375 feet, or 374 feet into the Trenton. The Ohio Oil Co. is drilling No. 3 Charles B. and Ida L. Miller farm, Section 31, Pleasants Township, Seneca County.

Ridge Gas & Oil Syndicate is drilling No. 5 Elnora Cross farm, Section 35, Biglick Township, Hancock County, the only well under way in the county at this time.

In Lucas County, John Doblinger is drilling a wildcat on the Glen Lose farm, Section 8, Monclova Township, and M. Gray is drilling on the Kile Brothers 100 acres, Section 28, Springfield Township.

Old Wells Abandoned

In Lucas County, Jerusalem Township, and east of Toledo, the Ohio Oil Co. pulled out and abandoned old Nos. 1, 2, 3 and 4 W. Niles farm, Section 29, and August Cedoz did the same with No. 3 fee farm, Section 8.

In Sandusky County, Madison Township, the Ohio Oil Co. abandoned Nos. 1, 2, 3, 4, 6 and 7 Richard W. Fickes farm, Section 32.

In Wood County, Montgomery Township, the Ohio Oil Co. abandoned Nos. 2, 3, 4, 6, 7, 8, 9, 10, 11 and 12 Sarah Lansdale, and Nos. 8, 9, 11, 12, 14, 16 and 18 A. Hyter farm, all in Section 11. In Plain Township, near Bowling Green, same company abandoned Nos. 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 and 16 Lehman Brothers farm, Section 35, and Collins and Wilson pulled out Nos. 6, 7 and 8 Robert C. Minear farm. In Liberty Township, same county, the Ohio Oil Co. abandoned No. 12 W. F. Kinney farm, Section 12, also Nos. 1, 2, 3, 4, 5, 6, 7 and 8 Josiah Bordner farm, Section 9. In Henry Township, same company abandoned Nos. 5, 14 and 16 J. W. Sharp farm, Section 10; No. 31 William Hamman farm, Section 10; and Nos. 9 and 11 B. E. Sterling farm, Section 22.

CENTRAL OHIO

Thirteen completions were reported from the Central Ohio Field of which 2 were producers with an initial of 11 bbls., 4 dry holes and 7 gas wells, while there were 2 locations staked and 8 wells started spudding, a total in new work of 10. The slowness of completions is due to the weather conditions, as well as a scarcity of water for drilling purposes in many parts of the field.

Ashland County failed to report even one completion. In Medina County a dry hole was drilled by the Myers Oil Co. on the George Keener farm, Lot 82, Harrisville Township, after drilling through what is usually the pay sands. The first pay sand was found from 2,700-23 feet and from 2,749-56 feet, both being dry. In Chatham Township, Edson Sons Co. is drilling No. 14 Marcus A. Frank farm, Lot 20, and No. 14 George W. Packard farm, Lot 4.

In Lorain County, Columbia Township, Dillon & McFredericks' No. 1 E. N. Gilpin farm, Lot 72, was a dry hole from 2,657-66 feet.

In Wayne County, Congress Township, Ohio Fuel Gas Co. has a gas well in No. 3-5,410 Mary Hagerman farm, Section 6.

In Cuyahoga County, Strongville Township, Dillon & McFredericks are drilling No. 1 W. C. Fetterman farm, Lot 58.

In Licking County, Mary Ann Township, Armbruster & Strickler's No. 9 William Strickler farm, Section 23, is a very light gas well from 623-32 feet, and Fred Eshleman has one of the same kind in No. 1 on his own farm, same section, from 625-33 feet.

In Muskingum County, Perry Township, the Atha Co. has a light gas well in No. 1 Robert E. White farm, in the third quarter of the township, at 4,053 feet.

In Athens County, Alexander Township, Bowser and others' No. 2 G. W. Riley farm, Section 30, is an average gas well in the Maxon sand from 540-55 feet. Frank O'Mara and others' test on the Nelsonville Brewing Co. property, Section 17, York Township, is a fair gas well in the Clinton lime from 3,220-55 feet. Letonia Oil & Gas Co. is drilling on the Lizzie Robinet farm, Section 19, Lee Township. In Waterloo Township Grass Run Oil Co.'s No. 1 P. R. Devore farm, Section 23, is good for only 1 bbl., in the Berea sand at 1,070 feet.

Tuscarawas County

In Tuscarawas County, Washington Township, the Capital Drilling Co.'s No. 4 Stewart Asher farm, Lot 19, is reported at 10 bbls. initial from 3,650 feet, and the Gordon Oil Co. has a fair gas well in No. 1 Clarence Hague farm, Lot 35, same township. Top of lime was found at 3,336 feet and total depth 3,613 feet.

In Stark County, Timken and others' No. 1 A. T. Snyder farm, Section 8, Paris Township, was dry at a total depth of 5,280 feet. In Jackson Township East Ohio Gas Co. is drilling No. 1 H. B. Faucett farm, Section 17; No. 2 T. K. Harris farm, Section 34; and No. 1 on the Tom O'Shanter Golf Course, Section 26, same township.

In Belmont County, Somerset Township, Central Gas Co. is starting on the H. B. and R. B. Mann farm, Section 7. W. C. McBride, Inc., is starting No. 1 Carrie J. Smith farm, same section, and Carrie J. Smith and others are drilling No. 1 Carrie J. Smith farm, also in Section 7. M. W. Fulton and others are drilling No. 4 N. E. Slevin farm, Section 27, same township.

INDIANA

Only two completions were reported from Indiana and both are very good oil wells. They are the Ohio Oil Co.'s No. 2 in the northwest corner of the Mabel Prevo farm, SE, Section 32, Prairie Creek Township, Vigo County, and had an initial production of 60 bbls. from a total depth of 2,227 feet. The Siosi Oil Corp.'s No. 20 in the northeast corner of the William Riggs farm, Lease 38-40, Section 32, produced 55 bbls. the first 24 hours at a total depth of 2,218 feet. Thomas and Ellis are drilling on the W. P. Collins farm, Section 31, same township.

In Curry Township, Sullivan County, James C. Ellis, Kentucky oil operator, is drilling on the William Jewell farm and on the Martz heirs estate, both in Section 32. H. Huntsman and others are drilling No. 2 Katherine Piety farm, Section 7, Turman Township, same county. No. 1 on this farm was a gas well.

Steffy & Grass are drilling on the George Santer farm, Section 2, Huff Township, Spencer County, in the southern part of the State. Seitz & Medley are drilling No. 1 Phillips heirs farm, NW, Section 11, same township.

Seitz and others are drilling deeper their No. 1 on the Isaac Seibert farm, in Tobin Township, Perry County.

ILLINOIS

In the old northeastern Illinois Field, in Montgomery Township, Crawford County, John Phipps' second test, 600 feet from the south line and 1,850 feet from the east line of the J. W. Laughead farm, NE, Section 3, was drilled to a depth of 1,026 feet, where it was dry, but was plugged back to 970 feet, where a fair gas volume was found and is being utilized for gas. Jones and others are starting a test on the C. A. Taylor farm, Section 12, Honey Creek Township, same county.

Stifal, Hammer and others are drilling on the J. C. Lawrence farm, Section 36, Casey Township, Clark County.

The Dupo Field of St. Clair County was hard hit by failures since the last report from that one-time active town lot development. The Majestic Oil Co.'s No. 1 L. E. Inglehart farm, Section 33, Sugar Loaf Township, is dry at 705 feet, and the same company's No. 1 P. F. Fisher farm, Section 21, went to a depth of but 110 feet and was abandoned. W. S. Avery's No. 1 G. H. Ruble, same section, was dry at 575 feet, as was the Dupo Oil Investment Co.'s No. 1 S. Zebos, same section, given up as dry at 315 feet. Otto Karbe abandoned No. 1 August Daab farm, Survey 45, same township.

SOUTHWESTERN KENTUCKY PRODUCER SHOWING OVER 100 BARRELS INITIAL

By George A. Whitney
Staff Correspondent Kentucky Fields

HORSE CAVE, Ky., Mar. 2.—The theory of many that southwestern Kentucky would never produce oil in commercial quantities missed the mark, for one of the latest completions in that part of the State has proved a nice producer and has been estimated as showing for better than an initial of 100 bbls., the oil being found in the Bethel sand, better known in the Owensboro Field as the Barlow sand and at a shallow depth of 643 feet. The well is owned by the Standard Exploration Syndicate of Cleveland, Ohio, which acquired a large block of acreage on the Farmersville Dome in the northwestern part of Caldwell County, and is located on the J. M. McNeely farm, northwest of the town of Farmersville, which is 6 miles north and a little west of Princeton, the county seat. The oil is of a very good grade, having no sulphur in it, being a black oil. This well is the second drilled on the McNeely farm, both being producers, and No. 3 is now under way. Both wells are connected and flowing their oil into tanks, with no present outlet for the crude, the railroad being about 4 miles distant. The Farmersville Dome was geologized by the late Prof. Stewart Weller of the Chicago University, who spent several years in that part of Kentucky doing work for the mining people at which time he noticed the oil possibilities. H. C. Crow, trustee for the syndicate, believes a much deeper pay sand will be found in the same vicinity and that large producers may be found in the lower pay sands.

The coming spring should show great activity in many parts of Kentucky. Green, Adair, Metcalf, Taylor and Marion Counties look like a good bet for the current year. In Green County there is a gas field which begins miles south of Greensburg, the county seat, and runs in a northeast direction into the adjoining county of Taylor. The total length of the field as tested is close to 20 miles and the average depth from 2 to 6 miles.

Green County was one of the early counties of Kentucky to be given a test for salt, during the year of 1850. Gas was found at a depth of 300 feet, in what is now known as the Green & Taylor gas sand, or the Irvin sand, being so named by the state geologist, Doctor Jillson, the sand from which gas is being produced in Green and Taylor Counties at this time.

Since 1916 quite a number of nice gas wells were drilled in Green County, some showing a volume of 5,000,000 feet. Oil was also found in a number of wells, with flush production from 10 to 20 bbls., but due to encountering salt water with oil, have been unable so far to operate profitably. The oil is very live, being 41-42 gravity, light green. A number of dry holes were found, as the oil lies in pools. Beginning 2 miles southwest of Greensburg and running southwest 10 miles to Little Barren River, and for 4 miles on each side of the line, every well that was drilled in this section has showed oil. This, with the amount of gas that has been found, is thought to insure the opening of an oil field in Green County. The average depth of the wells is approximately 400 feet. Oil and gas is found below the shale, which runs about 55 feet, cap from 8 to 10 feet.

Hart County Gusher

Smith, Daugherty and others made an excellent oil strike in No. 1 on the P. T. Larimore farm, east of the recent good well found on the Mrs. S. W. Burf farm, in the north end of the Legrande Pool of Hart County. The well had a large production initially and is rated good for 350 bbls. Tichenour & Mann's test on the Gault Terry farm, one-half mile northeast of Wabash and 2 miles west of Hammonsville, at last reports was at a depth of 794 feet and 26 feet in the sand with no showing of oil or gas. Same firm is drilling on the R. T. Reynolds farm, south of Bonneville, same county. J. H. McClurkin, old-time operator and geologist, is drilling on the W. L. Chaney farm in the Legrande Pool and also drilling a well on the Blain Vance farm in the Powder Mill area, same county. Mecca Oil Co. is drilling No. 1 W. W. Stales farm, 1 mile northeast of the big oil well on the Bradley farm, in Logsdon Valley, southwest of Munfordville. The Bradley farm well was reported for better than 500 bbls. and appears to be another pool northwest of the Legrande Pool.

Other Development Work

In the Greenville Field of Muhlenberg County, the Ohio Oil Co.'s test on the

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Three Mile Extension in Gregg County

Kilgore Field Extended Mile North. Crooked Holes in Joiner Field. New Pipe Line Activity in Both Counties

By L. E. Bredberg
Fort Worth Bureau, The Oil and Gas Journal

FORT WORTH, Tex., Mar. 2.—At the present writing there are now 100 locations, drilling wells and wells rigging up or ready to spud in the Joiner area, Rusk County, with 28 wells producing and 6 abandoned on the northeast, eastern and southeastern edge, with one 2 miles to the south. There are 51 active tests in the Bateman or Kilgore area in northern Rusk County, and 6 wells on production in this pool, with one test to the northwest in a doubtful situation as to whether it will make a producer and extend the field in that direction. It is 2 miles northwest of the Bateman discovery well and will be the first dry hole in this area if the sand is missed. There are 25 active tests in the Farrell-Lathrop area, Gregg County, and a total of 43 in the whole county, with the discovery well and a 3-mile extension test being the only two wells drilled to the sand to date. However, the last mentioned well has not yet been completed, but has been estimated good for about 500 bbls. per day, making the second well for the county.

These activities in the two counties total 202, but locations are made so rapidly, and derricks erected accordingly, that it is difficult to keep up with the total activities and all the drilling wells.

It is reliably reported that the I.&G.N. railroad has leased approximately 10 miles of its right of way on its main line west of the Joiner Field, near Overton, and that the Petroleum Marketing Corp., the lessee, would drill a series of wells within 30 days of the completion of each other if the first and succeeding tests on this land prove productive.

The three producing areas in Rusk and Gregg County have produced a little better than 715,000 bbls. since discovery of the Joiner Field and subsequent discovery of the second two. The Joiner Field has produced around 570,000 bbls., the Bateman Pool 45,000 bbls. and the Farrell-Lathrop well 100,000 bbls., all of the oil going to storage or being shipped out by tank car from the various pools, as there is yet no trunk line serving either field.

Farrell-Lathrop Area

The Farrell-Lathrop area, Gregg County, was given a 3-mile extension on March 1 when Frank Foster and East Texas Refining Co.'s No. 1 Fisher, in a 98-acre tract in the John Ruddle Survey, 3 miles south, 25 degrees west of the discovery well of the county, made its first showing of oil from 3,480-3,542 feet on a drill stem test, and later made three heads of oil through the drill stem, the oil coming from sand encountered at 3,505 feet. Sand and shale was cored in the well, and a good thick body of concentrated sand was not reported from the field, the formation seemingly being broken up by the shale, thereby making the test appear as a defining well, while at the same time it is an extension in the direction of the Bateman area, 10 miles farther south in northern Rusk County.

The test topped the Pecan Gap at 2,320 feet and went out of it at 2,882 feet, topping the Austin at 3,460 feet and drilling through it at 3,490 feet. Elevation of the well is 333 feet. Elevation of the Farrell-Lathrop discovery well, to the north, is 401 feet, the Pecan Gap was logged from 3,458-3,870 feet and the Austin chalk from 3,528-3,554 feet. The producing horizon was encountered at 3,569 feet, and the total depth of the well is 3,587 feet. These figures show the second producer to be running a little lower than the discovery well.

Mammie Hammon and others' No. 1 Hamby in the Martin Lant Survey, 4 miles northeast of the Gregg County discovery, cored shale from 3,517-20 feet, and is now drilling at 3,540 feet. No Austin chalk has been logged in this test, and the present appearance is not so encouraging. Elevation is 376 feet and the Pecan Gap chalk was topped at 2,506 feet and the base at 2,848 feet. This has been one of the most interesting tests of the three areas, especially in the Farrell-Latrop area, and much later development and many later activities are hinged upon this test.

The Simms Oil Co., Dallas, announced it would lay a line into the Farrell-Lathrop area, where it has one test ready to spud in, and build a loading rack on the T.&P. railroad at Willow Springs switch, from which place it would ship oil to its Dallas refinery. The Shell Petroleum Corp. has also mentioned that it might lay such a line into this area. The East Texas Refining Co. is now ready to start construction on its 4-inch line into Longview, where it is erecting a 6,000-bbl. refinery. The line will connect with the well which came in today and will serve all leases in which the company is interested, also taking oil from other companies' leases.

Bateman Field

The Bateman or Kilgore Field was given an extension of 1 mile north this week when Smith's No. 1 D. M. Peterson heirs, in the Isaac Ruddle Survey, came in for an initial production of 170 bbls. per hour through three-quarters-inch choke, flowing 9,140 bbls. in 52 hours. It is now flowing through a thirty-nine-sixty-fourths-inch choke. Oil sand was cored from 3,662-68½ feet, total depth being 3,668½ feet.

Federated Oil Co.'s No. 1 Ben Laird, approximately midway between the Bateman discovery and Peterson well, also came in this week, making 208 bbls. the first hour through three-quarters-inch choke. Sand in this well was topped at 3,624 feet, total depth of the hole is 3,654 feet. Elevation is 395 feet.

The Magnolia Petroleum Co. has a test on the W. R. Crim farm in the Robert E. Winn Survey ready to be brought in next week. Karona Oil Co.'s No. 1 Peterson, in the Robert Winn Survey, was completed March 1 making a short extension in the southern part of the Bateman Pool, in the extension area on the Crim farm. This well flowed at the rate of 100 bbls. per hour through a three-quarters-inch choke from sand cored at 3,600-16 feet. Two and a half inch tubing was run to 3,604 feet.

The Humble Pipe Line Co. has not resumed construction of its 8-inch line into the Kilgore area after construction was stopped 3½ miles north of the field, but the company is shipping out oil from loading rack constructed just north of the discovery on the D. M. Peterson heirs' farm in the Isaac Ruddle Survey. The company is also contracting with royalty owners for their oil at 60 cents per barrel which is 20 cents above the posted price of oil from the Joiner Field.

Rumors stated that the Magnolia Pipe Line Co., which is laying a 10-inch line into the Kilgore and Farrell-Lathrop areas, had shut down on construction, but this was not so and the company intends having the line ready to run oil in about 15 days. The line will be approximately 70 miles long.

Another outlet is promised the Kilgore area by the Gulf Pipe Line Co., for that company has completed survey from its Oklahoma to Port Arthur trunk line to its block northeast of the town of Kilgore and will lay a line as soon as the test now drilling on the block, proves productive. The Houston Oil Co. will also lay another line out of this field. It will run about 11 miles west to the Cotton Belt Railroad connecting to a loading rack at Amigo Switch from which point crude is to be shipped. It already has a loading rack on the I. & G. N. Railroad north of the Bateman discovery, and a gathering line connected with several of the producing wells in the field.

EAST CENTRAL TEXAS PRODUCTION

Boggy Creek	2,600
Cedar Creek	85
Carrie	300
Hill County	30
Mexia	3,729
Nigger Creek	175
Powell	4,840
Richland	105
Rusk and Gregg Counties—	
Joiner	32,047
Kilgore district	10,437
Van	31,098
Wortham	570
Total	75,966
Week ended February 21	67,549
Increase	8,417

South of Joiner Field

Capps and Smith's No. 1 J. L. Cochran, in the Jacob Roth Survey, several miles south of the Joiner Field, Rusk County, has been the center of attraction during the week, and acreage and royalty prices took a jump on acreage surrounding the test. The last report stated it was coring sandy shale and shells at 3,640 feet. Elevation is 386 feet. It topped the Pecan Gap chalk at 2,703 feet and went out of it at 3,045 feet, topping the Austin chalk at 3,475 feet, running considerably lower than the lowest wells in the Joiner Field.

The Sinclair Oil & Gas Co. brought in its first well in the Joiner and East Texas district, this week. This well is No. 1 W. W. Holland in the Juan Ximenes Survey, which lease was purchased a few weeks ago when the company made its entree into the field. The well flowed 700 bbls. during 20 hours on March 1, the sand having been cored from 3,627-49 feet.

Tidal Oil Co.'s No. 1 Holland, west offset to the Sinclair well, has been swabbing in an endeavor to make a flowing well out of it. Saturated sand was cored from 3,633-41 feet, 3,657-63 feet and 3,668-74 feet, 20 feet of saturated sand, but encountering hard shale from 3,674-76 feet and black sandy shale from 3,676 feet at which depth it now stands. The well has refused to flow regardless of the amount of saturated sand in the hole, and it is another case of lack of gas pressure. Other producers in the field have gone dead because of lack of gas pressure, and because of screens or perforated liners sanding up, and the lack of gas allows the opinion that pumping equipment may soon need to be installed on many of the wells in order to produce them.

No water has appeared in the Gregg County discovery of Arkansas Fuel Oil Co., Farrell and others on the Lathrop farm in the William Robinson Survey, but last week the temperature of the oil rose to an alarming extent giving rise to the belief that hot salt water was near. Temperature of the oil at the well was 130° and at the tanks it tested 108° with tubing pressure at 280 pounds and casing pressure at 400 pounds. Friction was advanced as a possible explanation of the rising temperature, but engineers discounted this theory. The well has been producing around 4,200 bbls. daily through seven-eighths-inch choke. The Yount Lee Oil Corp. has been dealing with Farrell and associates for their offsetting leases and half interest in the well, but no deal has yet been con-

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EAST CENTRAL TEXAS WILDCATS

Week Ending March 2

CHEROKEE COUNTY

McDonald Bros.' No. 1 Newton, center of 113-ac. tract, Thomas Quevedo Sur., 3 miles N of Jacksonville .... Derrick.
R. G. Baker et al's No. 1 M. M. Tommie, 945 ft. N and 1,300 ft. E, William George Sur. .... Drlg. 3,657 ft.; top Pecan Gap 3,054 ft.; base Pecan Gap 3,399 ft.

DELTA COUNTY

Delta Development Co.'s No. 2 Hays Kinney, 300 ft. S of No. 1 Cooper, Townsite Sur .... Shut down 1,905 ft.
D. S. Hoods' No. 1 J. J. Balser, 185 ft. from S and 680 ft. W of Balser 40-ac. tract in SE cor. T. B. Laddin Sur. .... Shut down 1,559 ft.
Everett Drlg. Co.'s No. 1 Sansivy, 1,320 ft. N and 1,320 ft. W, J. B. Craig Sur. .... Shut down 2,984 ft.
Worthington and Stedman's No. 1 W. H. Dejehett, 150 ft. from S and 776 ft. from W of 52-ac. tract, E. Chick Sur. .... Shut down 1,927 ft.

GREGG COUNTY

Arkansas Fuel Oil Co.'s No. 1 R. S. McKinley, 990 ft. from N and W of most northern cor. 212-ac. tract, William Robinson Sur. .... Drlg. 2,565 ft.; top Pecan Gap 2,440 ft.
Eslick's No. 1 Church Lot, 150 ft. N and 150 ft. W of N 15 acres, Dolores Sanches Sur. .... Drlg. 2,705 ft.
Bell & Graddy's No. 1 M. George (or Daniels), 225 ft. S and 650 ft. W of 26-ac. tract, Mary Van Winkle Sur. .... Shut down 632 ft.
W. H. Byrd, Jr.'s No. 1 Art Mitchell, 150 ft. from E and 150 ft. from S of 15-ac. lease, 1,300 ft. from S and 850 ft. from E of survey, John Carithers Sur. .... Derrick.
D. H. Byrd and Gulf Prod. Co.'s No. 1 Canimaras Bros., 5,505 ft. from NW, 1,528 ft. from NE of 817.6-ac. tract, 1,820 ft. from N, 2,505 ft. from W of survey, Harden Edwards A-64 Sur. .... Moving in material.
East Texas Refining Co. et al's No. 1 Fisher, 200 ft. N and 200 ft. W of E 98-ac. tract, John Ruddle Sur. .... Coring 3,524 ft.
East Texas Ref. Co. et al's No. 1 B. Rodden, 200 ft. from N, 200 ft. from E of 32-ac. lease, 3,700 ft. from W, 6,400 ft. from N, William Robinson Sur. .... Top Pecan Gap 2,405 ft.; drlg. 2,890 ft.
D. H. Felder's No. 1 Elder (Trip), 200 ft. N and 200 ft. W of Elder tract, J. W. McCorry Sur. .... Drlg. 3,550 ft.; top Pecan Gas 3,510 ft.
M. S. Hammond's No. 1 J. M. Hamby, 278 ft. from E line, 1,667 ft. S of Hamby 3,800-ac. tract, Martin Lant Sur. .... Reaming 3,515 ft.

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Penn Pool Test Shot Makes 350 Bbls.

Andrews County Test Still Drilling and Southwestern Terrell County Test Shut Down Waiting for Equipment. Price Changes

By L. E. Bredberg
Fort Worth Bureau, The Oil and Gas Journal

FORT WORTH, Tex., Mar. 2.—One of the main features of the Permian Basin this week was the shooting of Skelly Oil Co. and Republic Producing Co.'s No. 1 McKenzie, 990 feet from south and 330 feet from the east of Section 28, Block 45, T.&P. Survey, 1 mile north of production in the Penn Pool, a 350-bbl. producer. The shot was given the tight lime from 3,645-3,725 feet and accomplished its purpose, bringing about a producer out of a test which had been shut down for several months looking like a complete failure.

The Phillips Petroleum Co. and Tidal Oil Co. may give their test a shot after seeing what 200 quarts did to the Skelly-Republic well. The former well stands shut down at a total depth of 3,800 feet, looking like a failure. It has also been standing shut down for several months. It is in the NW of Section 6, Block 44, T.&P. Survey, Township 3s.

Deep Rock Oil Co.'s No. 1 Kuykendall, western extension of the Ogden Pool, Andrews County, is not having much luck in showing as a commercial producer, as it is drilling ahead at 4,635 feet in lime with only 2,800 feet of fluid in the hole, mostly oil.

Mid-Kansas Oil & Gas Co.'s No. 1 Goode in Section 26, Block 161, G.C.& S.F. Survey, southeastern Terrell County, is still shut down at 5,612 feet waiting for the installation of steam equipment. This is the test which created considerable excitement two weeks ago when it encountered 6,500,000 feet of gas at 5,605 feet. Drilling 7 feet deeper did not increase the flow of gas.

Ector County

Southern Crude Oil Purchasing Co.'s No. 2 Cowden, half mile south of its north Ector County discovery well, is expected to top the lime this week, providing the lime is logged in neighborhood of lime in first test in this area. It is now drilling at 3,825 feet. Brown lime was topped in the discovery well at 3,875 feet, and gray lime was topped at 4,020 feet with a surface elevation of 3,047 feet. Surface elevation of the second test is 3,065 feet. This is the only active test in northern Ector County at the present writing.

Pressure on the eight deep producing wells in the Big Lake Field, Reagan County, has been regulated to the extent that the wells show a decline in production for the third consecutive week. This week the wells produced a total of 130,-991 bbls., or a drop of 2,085 bbls.

Crude continues to be withdrawn from storage in the Permian Basin and the last report shows a daily average withdrawal of 58,755 bbls., an increase of 14,805 bbls. daily. A decline of 2,165 bbls. of daily average production and an increase of 12,640 bbls. in daily average distribution made the increase in withdrawals. Refinery and pipe line runs increased their total daily runs, while tank car shipments showed a decline of 3,565 bbls. per day.

Panhandle and Wichita Falls

Effective 7 a.m. March 1, the Panhandle Refining Co. of Wichita Falls posted a flat price of 72.5 cents per barrel, f.o.b. its refinery, for crude purchased in North Texas. This follows other changes which were made during the week by local refineries, and takes the prices out of the gravity basis.

Effective the same day, the American Refining Co. of the same place posted a new price schedule for crude from southern Oklahoma and North Texas. The new schedule lowers the price of North Texas crude 12 cents per barrel. For southern Oklahoma crude of 28 degrees and below it will pay 43 cents per barrel with a 2-cent differential up to 39 degrees and above, making top price 65 cents per barrel. In North Texas they will pay 50 cents per barrel for 34 gravity and below with a 2-cent differential up to 39 degrees and above, making top price 60 cents per barrel. On North Texas crude, if the pipe line company charge is over 12½ cents per barrel, the American Refining Co. will charge the producer with the difference; in other words, if the tariff is 20 cents from one point to another the American Refining Co. will absorb the 12½ cents and the producer will be charged with the balance.

The Dale Refining Co. at Iowa Park posted 54 cents for 36-degree oil with a top price of 67 cents for 40 gravity and above. The Iowa Park Refining Co. posted a price of 72½ cents per barrel, f.o.b. its refinery at Iowa Park, effective 7 a.m. February 24.

East Texas oil has made itself felt in the North Texas district, for oil from the former is being shipped in to refineries at Wichita Falls in competition with oil from that district.

The Golson Pool, Coleman County, is the only active area in the Ranger district. Three wells were completed in the pool this week.

WEST TEXAS PRODUCTION
Week Ending February 28

Andrews	3	116
Crane	373	18,795
Crockett	50	1,755
Ector	77	6,510
Fisher	10	711
Garza		26
Howard-Glasscock	536	26,561
Irion	7	66
Jones	76	1,234
Loving	37	3,430
Mitchell	151	1,970
Pecos	533	95,631
Reagan	255	29,315
Runnels	5	139
Scurry	5	6
Upton	257	5,410
Taylor	3	127
Ward	52	3,357
Winkler	593	50,194
Total production this week		245,353
Total production last week		245,820
Decrease		467

COMPLETIONS IN WEST TEXAS

Crane County

Gulf Production Co.'s No. 1 McElroy, top pay 2,765 feet, shot 285 quarts 2,763-2,819 feet, initial production 290 bbls., total depth 2,983 feet. Prairie Oil & Gas Co.'s No. 7-A University, top pay 2,960 feet, shot 60 quarts 2,975-3,050 feet, shot 100 quarts 2,975-3,050 feet, initial production 75 bbls. per day, total depth 3,060 feet.

Loving County

Cromwell and Atlantic Production Co.'s No. 1 George Russell, top pay 4,205 feet, total depth 4,247 feet, plugged back to 4,245 feet, initial production 282 bbls. per day, shot 180 quarts 4,200-44 feet. Miller, Burge & Healey's No. 1 Chapman, top pay 4,285 feet, shot 175 quarts 4,285-4,325 feet, total depth 4,382 feet, plugged back to 4,368 feet, initial production 35 bbls. per day.

Pecos County

J. R. Bell and others' No. 1 Scharff & Blackman, top pay 1,585 feet, initial production 3 bbls. per day flowing, total depth 1,624 feet. B. C. Mann's No. 1 Schaff & Blackman, dry and abandoned, total depth 2,098 feet. Mid-Kansas and Arkansas Fuel Oil Co.'s No. 2-A White and Baker, total depth 1,922 feet, plugged back to 1,880 feet, top pay 1,855 feet, initial production 2,500,000 feet of gas. Shilling & Slaughter's No. 1 Tippett, dry and abandoned, total depth 337 feet. William & Moran's No. 1 State, dry and abandoned, total depth 1,890 feet.

Real County

Evans & Tant's No. 1 M. L. Crider, location abandoned.

Upton County

Penn and Shell Oil Corp.'s No. 1 Halamicek, dry and abandoned 4,722 feet.

Ward County

Empire Gas & Fuel Co.'s No. 1 Smith, top pay 2,582 feet, initial production 30 bbls. per day through 3-inch tubing, total depth 2,615 feet. Kugle and others' No. 1 J. C. Wallis, top pay 2,448 feet, initial production 80 bbls. per day on swab, total depth 2,462 feet.

COMPLETIONS IN PANHANDLE

Carson County

Interstate Production Co.'s No. 1-100 Burnett, top pay 2,671-2,708 feet, initial production 43,000,000 feet of gas, total depth 2,708 feet. Texas Interstate Pipe Line Co.'s No. 1-51 Burnett, good show oil 2,330 feet, increase 2,355 feet, 3,000,000 fet of gas at 2,370 feet, 16,000,000 feet of gas at 2,440 feet, total depth 2,503 feet.

Gray County

Cockrell-McIlroy's No. 5 Castlebury, top pay 3,224-77 feet, shot 190 quarts in pay, initial production 23 bbls. in three hours, total depth 3,279 feet. Magnolia Petroleum Co.'s No. 2 Heitholt, total depth 3,250 feet, plugged back to 3,245 feet, top pay 3,237-45 feet, initial production 15 bbls. oil and 2 bbls. of water.

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WILDCAT OPERATIONS IN WEST TEXAS

Week Ended March 2

Company, well, farm name, section and block—	Remarks—
ANDREWS COUNTY	
Deep Rock Oil Co. et al's No. 1 Kuykendall, 2,310 ft. from N and E of SW cor., Sec. 24, School Blk. A-46	Drlg. 4,650 ft.; 3,000 ft. oil in hole.
Deep Rock Oil Co. et al's No. 1 King, 330 ft. from N and 2,310 ft. from E, Sec. 11, Blk. A-46	Top pay 4,335 ft.; flows every 4 days; temporarily abandoned; total depth 4,454 ft.
BREWSTER COUNTY	
Brewster Oil Co.'s No. 1 fee, 2,640 ft. S and 2,598 ft. E of NW cor., Sec. 45, Blk. G-15, G.C.&S.F. Sur.	Shut down 1,935 ft.
E. L. Chapman's No. 1 Skinner, C SW SE, Sec. 100, Blk. 2, G.C.&S.F. Sur.	Shut down 1,302 ft.
Trans-Pecos Oil & Gas Co.'s No. 1 Jones, 920 ft. from N and 2,500 ft. from E of Sec. 18, Blk. G-15, G.C.& S.F. Sur.	Drlg. 2,800 ft.
Van McPhail's No. 1 McIntyre, SE cor., Sec. 59, Blk. 352, 7 miles S of Alpine	Shut down 1,750 ft.
COKE COUNTY	
Reed, Hitchens et al's No. 1 Duncan, 1,980 ft. from S and 1,650 ft. from E of Sec. 239, Blk. 2, H.&T.C. Sur. (4,500-ft. cable test)	Shut down 30 ft.
CONCHO COUNTY	
Beesley et al's No. 1 Waring estate, 400 ft. from N and E, Sec. 163, T.&N.O. Sur.	Shut down 267 ft.
Turner et al's No. 1 Borsig, 150 ft. from S of NE cor. G. Emmig Sur. 130, 6 miles W of Paint Rock	Drlg. 1,695 ft.
CRANE COUNTY	
Cranfill Bros. and Gulf's No. 1 J. B. Tubb, 2,310 ft. from N and 330 ft. from E of Sec. 8, Blk. B-27, Public School Land	Drlg. 4,986 ft.
Cranfill Bros.' No. 1 Muir, 330 ft. from N and 2,310 ft. from W, Sec. 23, Blk. B-27, Public School Land	Shut down 4,347 ft.
Duffey et al's No. 1 Cowden Bros. Co. (Gulf), 990 ft. S and W of C, Sec. 81, Blk. X, C.C.S.D.&R.G.N.G. Sur.	Drlg. 2,150 ft.
CROCKETT COUNTY	
Doleman & Moore's No. 1 Perner, 3,135 ft. from N and 1,485 ft. from E of Sec. 36, Blk. 2, I.&G.N. Sur.	Spudded and shut down.
Taylor-Link Oil Co.'s No. 1 Mary Bullock et al, 330 ft. from N and E of Sec. 41, T.C. Sur.	Cleaning out 2,674 ft.; increase in oil 2,667-70 ft.

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WILDCAT OPERATIONS IN TEXAS PANHANDLE

Week Ending March 2

Company, well, farm name, section and block—	Remarks—
CARSON COUNTY	
Continental Oil Co.'s No. 1-A Jordan, 330 ft. S, 1,320 ft. W, SW, Sec. 123, Blk. 4, I.&G.N. Sur.	Drlg. 2,880 ft; 3,000,000 ft. gas 2,805-33 ft.
Krebs & Barnard's No. 1 Barnard, 660 ft. S and W, NW, Sec. 24, Blk. 4, I.&G.N. Sur.	Fishing 3,220 ft; estimated 100 bbl. from pay 3,212-18 ft.
North American O. & G. Co.'s No. 1 Burnett, 1,341 ft. S, 662 ft. E. of S E½ SE, Sec. 80, Blk. 4, I.&G.N. Sur.	Drlg. 850 ft.
Ochsner et al's No. 1 Moore, 330 ft. S and E, NW NE, Sec. 20, Blk. 7, I.&G.N. Sur.	Drlg. 2,525 ft.
Plains Holding Co.'s No. 1 M. P. Co. fee, C N 10 ac., N½ NW SW, Sec. 40, Blk. 4, I.&G.N. Sur.	Spudded.
Plains Holding Co.'s No. 1-A Kolka, 660 ft. N, 710 ft. E, NE NE, Sec. 43, Blk. 4, I.&G.N. Sur.	Drlg. 2,500 ft; top big gas pay 2,473 ft; estimated 50,000,000 ft. gas.
Red River Gas Co.'s No. 5-A Bivins, 1,320 ft. S, 660 ft. E, Sec. 45, Blk. B-20, G.&M. Sur.	Drlg. 270 ft.
Texas Interstate P. L. Co.'s No. 1 Burnett, C E½ SE, Sec. 51, Blk. 5, I.&G.N. Sur.	Spudding.
CHILDRESS COUNTY	
C. L. Sloane et al's No. 1 B. P. Smith, Sec. 49, F.P. Knott lands	T.D. 5,000 ft.
COCHRAN COUNTY	
Continental Oil Co.'s No. 1-B Slaughter, 4,950 ft. N and E, of League 134, Armstrong County School Lands	No information given out.
COLLINGSWORTH COUNTY	
Dixon et al's No. 1 Bell, 330 ft. N, 1,320 ft. W, Sec. 102, Blk. 21, H.&G.N. Sur.	U.R. 12½-in. csg. at 535 ft.
COTTLE COUNTY	
Darby Oil Co. and Merry Bros. & Perrin's No. 1 Richards, 330 ft. NE, Sec. 13, B.S.&F. Sur.	Drlg. 2,890 ft.
GRAY COUNTY	
Adams, Prince et al's No. 1 Morse, 330 ft. NE SE, Sec. 6, Blk. 26, H.&G.N. Sur.	Estimated 7,000,000 ft. gas 2,050 ft; estimated 17,000,000 ft. gas 2,245-60 ft; T.D. 2,300 ft; fishing tools.
Anderson et al's No. 2 Vollmert, 330 ft. N and W, SW, Sec. 140, Blk. 3, I.&G.N. Sur.	Rig.

(Continued on Page 160)

Two of a Number of Specific NAYLOR PIPE Savings in 1930

Laying a 14-inch Naylor Pipe Line

A SAVING OF $506.88 PER MILE. A well-known oil company made this saving on a 12" Naylor Pipe line. The laying costs of the whole line totalled only $100.32 per mile. A similar 12" line of standard weight, 18 to 22 foot random lengths, had cost this same company $607.20 per mile to lay. $506.88 more than Naylor Pipe had cost them!

A SAVING OF $500 TO $2000 PER MILE. The 16" Naylor Pipe shown in the photo at the left was trucked 31 miles; carted; strung and coupled at a total cost of only 11½ cents per foot. Compare this low cost per foot with your cost per foot for 16-inch standard weight pipe. The difference represented a saving of $500 to $2000 per mile for one oil company!

These savings were made possible because of two Naylor Pipe advantages—Light Weight and Unit Construction. Maximum Structural Strength and Long Life are other outstanding Naylor Pipe advantages that we would like you to know more about. Complete details gladly sent upon request. Write us!

NAYLOR PIPE COMPANY, Main Office & Plant, 1230 E. 92nd St., CHICAGO

PIPE CARRIED IN STOCK AT CHICAGO, HOUSTON AND LOS ANGELES

TONCAN COPPER Naylor Pipe

Maximum Structural Strength Mo-lyb-den-um With Minimum Weight

IRON

SALES OFFICES

NEW YORK 3116 Chrysler Building

PHILADELPHIA Witherspoon Building

TULSA 507 Philtower Building

HOUSTON 2301 Commerce Street

FT. WORTH: 402 Petroleum Building

LOS ANGELES: Champion & Barber, Inc., 576 Subway Terminal Building., Exclusive Distributors: California, Nevada and Arizona

MONTREAL, CANADA: Mechanical Equipment Company, 660 St. Catherine St., West

VANCOUVER, B. C.: Gordon & Belyea, Ltd., 101 Powell Street

MEXICO: C. H. Elstner, Apartado 284 Monterrey N. L.

Pipe Line Construction News

RUSK COUNTY AREA PIPE LINE PROJECT

HENDERSON, Tex., Mar. 2.—The Houston Oil Co., which has a gathering line in the Bateman or Kilgore Field and loading rack on the I.&G.N. railroad north of the field, is now contemplating running a line, probably a 6-inch, from this field to the Cotton Belt railroad, approximately 11 miles to the west, where a tank farm lease is being purchased and loading rack site is being leased at Amigo Switch, 4 miles south of the town of Winona in Smith County. The line is being laid to this road due to the I.&G.N. being so heavily taxed by incoming and outgoing freight and crude oil shipments from Arp, Overton, Henderson, Friar Switch, Kilgore and other points along the main line. The Cotton Belt does not have a line into any of these busy towns or switches, consequently is seeking business for its line which runs into Tyler from the west and north. Another pipe line connection is rumored for the line from one of the fields, and it looks as if many thousands of barrels of oil may be carried by this line at an early date, giving the fields extra outlets.

The Gulf Pipe Line Co. has surveyed for its line into the Kilgore Field to its Oklahoma-Port Arthur trunk line, which runs a few miles west of the field, and will construct a line to its leases around the Humble Oil & Refining Co.'s block and well which that company purchased from Ed. W. Bateman, discoverer of the field. It also has an interest in a block to the northeast of the town of Kilgore and is drilling a well on that block. In case that test is a producer the line will be extended to take oil from its leases.

The Magnolia Pipe Line Co. is stringing pipe for its 10-inch line from the Kilgore Field to its pumping station site in the John Groce Survey, Gregg County, from which place it is to run the line to its pumping station at Center in Shelby County on its Arkansas-Neches 8-inch trunk line.

The Hoffman Construction Co. is ready to commence laying an 8-inch line from the Joiner Field to Tyler, Tex., as soon as materials are shipped in. The survey has been completed for the 24 miles of line which will serve the Taylor Refining Co.'s 15,000-bbl. refinery at that place and perhaps serve another refinery which is contemplated being erected in Tyler. Murchison & Constantin of Dallas will build this line. This refinery was first named as having an 8,000 or 10,000-bbls. capacity, but G. L Rowsey announced that the capacity will be 15,000 bbls. per day. Mr. Rowsey is president of the Taylor Refining Co. and has headquarters at Taylor and Tyler, Tex. The line is to be a welded line.

L. G. Welch is trustee for the Central Pipe Line Co., which has completed a 45,000-foot survey from the Joiner Field. to a point 1½ miles north of the town of Overton, and will lay a Victaulic coupled 6-inch line using South Chester pipe. One 55,000-bbl. tank will be erected north of Overton and a 25-car loading rack built on the I.&G.N. at that point. Two 10,000-bbl. tanks will be built in the field by the company. M. L. Mays is superintendent for the company. G. F. Beckler, pipe line contractor, who laid the Inland Waterways Pipe Line Co.'s 4-inch line from the Joiner Field to Friar Switch, will lay the 6-inch line to Overton.

Moody-Seagraves, Inc., is preparing to lay a 6-inch line from its leases in the Western part of the Joiner Field, to a loading rack at Friar Switch on the I.&G.N. railroad and will ship out its own production and probably carry oil for some offset lease owners. The company is now constructing a production camp in the field on the Tyler-Henderson Highway and will carry on operations from its office in this camp.

The Rusk County Pipe Line Co., which has a 4-inch line running from the Joiner Field to a loading rack at Friar Switch on the I.&G.N. railroad, is extending that line another mile into the western part of the field to take oil from some of the newly completed producers in the extended area.

TEXAS BILL TO CONTROL RATES ON PIPE LINES

AUSTIN, Tex., Mar. 2.—Establishment of new basic pipe line rates is required of the Railroad Commission by house bill 554, offered by Representatives Young and Hardy. Senate bill 331 is identical.

Each of the measures provides that "the basis for all rates charged by any common carrier by pipe lines within this State shall be the payment of interest at the rate of 10 per cent on the money actually and necessarily invested in the construction and physical maintenance of such pipe lines and their physical properties, plus the return of such money within a reasonable time to be determined by the Railroad Commission."

In respect to existing pipe lines, however, and such lines as may come into existence before the act takes effect, the basis of rate computation is to be "the actual value of the physical property" at the time the rate is computed.

The bill makes it the duty of the commission to determine the value of all pipe lines now existing and the actual investment in lines built hereafter, and to fix rates as soon as the necessary information can be obtained. Before promulgating any rate, the commission is to hold hearings as to the lines affected. Power is given the commission to revise rates at any time and to permit any carrier by pipe line "to lower its rate so as to operate on an equal basis with a competing carrier performing the same or similar service."

The commission already has jurisdiction over pipe lines, with power to make, enforce and revise rates. Its authority is exercised, however, to the end of establishing rates and regulations that are fair and reasonable to all parties concerned, and not on the basis of any percentage return to the companies. Any person aggrieved at the rates may file a complaint with the commission, and if at a hearing the rates are found unreasonable the commission will change them.

In view of the existing law on the subject, opponents of the bills declare there is no necessity for them. They say also that bills require the commission to perform a practicable impossibility in figuring in advance rates that would pay a stated percentage annually on investments.

BIG LAKE GAS LINES

The Texas Public Service Co., successor to the Oklahoma Natural Gas Corp., is to begin laying two gas pipe lines from the Big Lake Field, Reagan County, to San Angelo, and to Rio Pecos. The former is to be a 12-inch and the latter an 8-inch line. Surveys for both lines are completed and work is to start by May 1. Gas will be taken from the deep producers in the Big Lake Field, the heat unit from this gas running 1,150 B t.u.

TO START HUGOTON LINE

DODGE CITY, Kans., Mar. 2.—Construction of the 300-mile pipe line from the Hugoton Field to serve Colorado Springs and 11 other towns in Colorado will be started April 1, Arthur K. Lee, president of the Eastern Colorado Gas Co., announced.

PIPE LINE SITUATION IN THE JOINER DISTRICT

FORT WORTH, Tex., Mar. 2.—The following is a general outline of all pipe line operations in the Joiner Pool of Rusk County:

The Panola Pipe Line Co. is purchasing approximately 2,500 bbls. per day. Its pipe line system consists of approximately 3½ miles of 4-inch line and a 25-car loading rack located on the Henderson & Overton Railroad. This oil is being shipped to the Sinclair Refining Co. at Houston, British American, Toronto, Canada, and the Shreveport-El Dorado Pipe Line Co. at Shreveport, La. The officers of the Panola Pipe Line Co. are H. L. Hunt, president; C. W. Hardin, secretary and treasurer, and H. H. Harter, vice president.

Warner-Quinlan Co. has just completed a 6-inch line from the Joiner Pool to a 25-car loading rack located on the Henderson & Overton Railroad; length of line approximately 3 miles. It is purchasing oil from the Shaw Oil Co. and W. R. Hamilton Co. Each of these companies has one well completed with an aggregate production of approximately 5,000 bbls. The purchase price of Hamilton's oil is not reported, but Warner-Quinlan has a contract with the Shaw Oil Co. for 1,000,000 bbls. as and if produced at 30 cents per barrel. According to advice from Mr. Tanner of the Warner-Quinlan Co., all this oil will be shipped to the company's refinery at Bayonne, N. J. The company expects to be handling as much as 20,000 bbls. per day in the immediate future.

The Deep Rock Oil Co. (Inland Waterways Pipe Line Co.) is connected with the Roberts Oil Co. and the Deep Rock production on the Ashby tract. The total production of both companies is approximately 6,000 bbls. According to advice from Mr. Roberts of the Roberts Oil Co. he is receiving 50 cents per barrel at the well for his production. The Inland Waterways Pipe Line Co. system consists of two 4-inch pipe lines approximately 3 miles in length from the Joiner area to a 15-car loading rack located in the I. Roberson farm, Penny Survey, on the Henderson & Overton Railroad. This oil is being shipped to the Crystal Oil Co. at Shreveport, La., and the Sinclair refinery at Houston, Tex. According to information the company expects to handle as much as 20,000 bbls. in the near future.

The Rusk County Pipe Line Co. is building a 4-inch line from Foster & Jeffries and others' Mayfield Alford lease to the Burford Oil Co.'s refinery site on the Henderson & Overton Railroad. The Rusk County Pipe Line Co. has a contract with Foster-Jeffries for their total production, this oil to be delivered to the Burford Refining Co. Purchase price of this oil is not reported, nor is the size of plant that Burford is building.

The Falls Refining Co. is erecting a small cracking plant on the Henderson & Overton Railroad approximately 4 miles north of the town of Henderson. It is also laying a 4-inch line into the Joiner area.

The Sinclair Refining Co. has started construction on a 40-car loading rack on the Henderson & Overton Railroad approximately 1,000 feet west of the Deep Rock Oil Co.'s (Inland Waterways) rack. It is reported that it will build a 6-inch line into the Joiner area.

The Arkansas Fuel Oil Co. has just completed a 6-inch line from its Lathrop well to the T.&P. railway where it is now building a 50-car loading rack. This oil will be shipped to Louisiana Oil & Refining Co. at Shreveport, La.

TO INCREASE CONTINENTAL LINE

The Continental Oil Co. of Ponca City, Okla., is preparing to increase the capacity of its 8-inch pipe line from the Oklahoma City Field to the refinery. It is expected the capacity will be increased from 12,000 bbls. to 30,000 bbls. a day by installing another pumping unit which will be built near the capital field and a booster station will be constructed at Orlando, in Logan County, about half way between the Oklahoma City Field and connection to the main line.

KIRBYVILLE-FRANKLIN LINE NOW UNDER WAY

Negotiations which culminated in an agreement to purchase the Lake Charles, La., gas plant and city distribution system from the Gulf States Utilities Co. were announced by the United Gas Public Service Co., a unit of the United Gas System.

Purchase of the Lake Charles system will make that city the headquarters of the entire division to be served by the new pipe line now under construction in southwestern Louisiana. D. S. McManus, division manager, already has temporary headquarters in Lake Charles.

The United Gas Public Service Co. has obtained franchises in 38 Louisiana communities and has started construction of a natural gas pipe line project from Kirbyville, Tex., to Franklin, La., a distance of 158 miles, with 265 miles of lateral lines.

The Lake Charles system will be taken over officially when natural gas is available for distribution throughout the city about July 1.

As soon as the necessary legal steps have been taken to close for the purchase of the gas company, engineers of the United Gas Public Service Co. will be put in the field to develop plans for enlarging the system, making it ready for the distribution of natural gas. It is estimated that the cost of the improvements at Lake Charles will be nearly $100,000.

CONSIDERING LINES TO FARRELL-LATHROP AREA

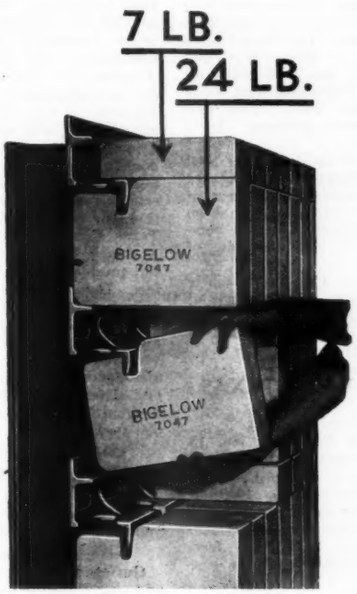
LONGVIEW, Tex., Mar. 2.—The Shell Pipe Line Co. is contemplating the laying of a line from the Farrell-Lathrop area, west of Longview, Gregg County, to the T.&P. railroad at a point near Willow Springs, near which place the Arkansas Fuel Oil Co. has a loading rack and is loading out oil to Shreveport, La., from the discovery well in which it has a half interest A 6-inch line connects the loading rack with the well. The Shell Petroleum Co. has considerable acreage near this well, and as soon as it drills in a well will no doubt start laying such a gathering line to serve its leases and other nearby leases.

The Independent Pipe Line Co., headed by Tom Cranfill, E. B. Germany and associates, are contemplating laying a line from the Farrell-Lathrop Pool to a point on the T.&P. railroad west of Longview, at which place a 50-car loading rack will be constructed if plans for the line materialize.

PETTUS TOWNSITE LINE

SAN ANTONIO, Tex., Mar. 2.—Henderson Coquat has completed the laying of a 6-inch natural gas line from the Pettus Townsite Field in northeastern Bee County to Three Rivers, 20 miles west in Live Oak County, where he furnishes gas to the city of Three Rivers and to industries, including a power plant. The Pettus townsite supply is to augment the supply from the gas field north of Oakville owned by Mr. Coquat.

ADVANTAGES OF THE BIGELOW *UNIT*-SUSPENDED FURNACE WALL



Every block in the Bigelow Wall is individually and positively supported directly from a bracket; it carries only one standard fire brick directly above it. The maximum load supported by any refractory unit is 31 lbs.—the block itself weighs 24 lbs. and the brick 7 lbs.

LONGER LIFE

One of the principal causes of spalling has been eliminated—*there is no cumulative loading on the refractory.*

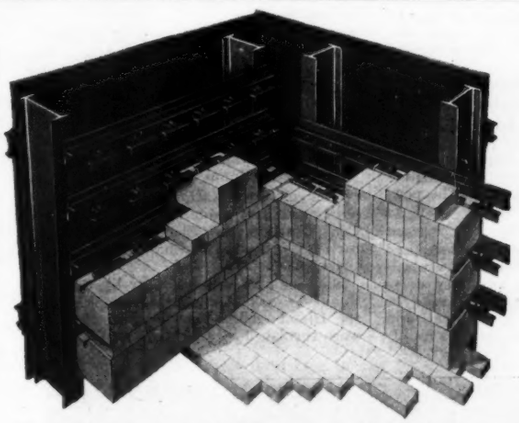
LESS MAINTENANCE

Repairs are seldom required, but they are quickly and cheaply made, since any block can be replaced without disturbing adjacent blocks. This minimizes the amount of refractory used for replacement.

GREATER ADAPTABILITY

The Bigelow Wall is easily applied to a great variety of furnace conditions. It can be sloped as desired without complicated and expensive supporting parts. Special blocks are seldom necessary even to provide openings for burners, etc.; and the supporting steel work will readily clear soot blower elements, cleanout doors, burners, etc.

The Bigelow Unit-Suspended Arch has these same characteristics.



One block shape, standard fire brick, and one kind of supporting bracket make up the Bigelow Air Cooled Unit-Suspended Furnace Wall.

BIGELOW-LIPTAK CORP. » 5053 WOODWARD AVE. » DETROIT, MICHIGAN

Sales Offices in Principal Cities » » *Canadian Licensees: Riley Engineering & Supply Co., Ltd., Toronto 10, Can.*
» » » *Main European Office: Liptak Furnace Arches, Ltd., 38 Victoria Street, London, S. W. 1, England*

BIGELOW-LIPTAK

A SUSPENDED WALL AND ARCH FOR EVERY FURNACE

NEW PUMP STATION AT SHELDON, MO. HAS UNIQUE LAYOUT OF MACHINERY

By L. G. E. Bignell
Petroleum Engineering Editor

When it became necessary to increase the capacity of the 12-inch pipe line system of the Texas-Empire company, extending from Seminole, Okla., to East Chicago, Ind., there were numerous problems confronting the designing engineers, and one of them was the installation of three large Diesel engine driven pump units in a building covering the minimum of floor space.

This problem was solved by setting these engines and pumps on lines diagonal to the center line of the building, as will

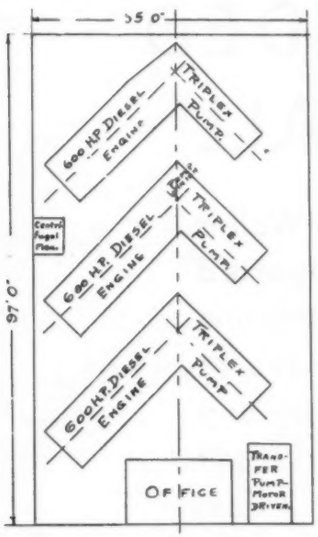


Diagram showing arrangement of engines and pumps in the Sheldon, Mo., pump station of the Texas-Empire Pipe Line Co.

be seen from the accompanying sketch and photograph of this installation.

These units are of a larger size than those used in the original pump stations on this line, being 600 horsepower McIntosh & Seymour Corp. Diesel type engines driving Prescott triplex pumps. The power is transmitted from engine shaft to pump shaft through gears.

This layout has conserved space and at the same time gives complete accessibility to every unit. The auxiliary units are so placed as to be separated from the main engines and pumps by fire wall and at one end of the building there is an office. The building has an outside dimension of 55'x97', or a total floor space of about 5,000 square feet.

This pipe line was originally opened in January, 1930, and is 673 miles in length not including approximately 225 miles of branch lines 10-inch diameter from Seminole to Cushing, Okla., and 12-inch diameter from Cushing, Okla., to East Chicago, Ind. Its original capacity was 50,000 bbls. of crude oil per day, but with the eight additional stations that have been added within the past six months it is now capable of handling 70,000 bbls. daily.

As originally completed there were 11 pump stations along this line, located at Lima, Davenport, Cushing and Alluwe, Okla., Scammon, Kans., Lowry City, Pisgah and Center, Mo., and Virginia, Heyworth and Wilmington, Ill. Eight of these stations were powered with Diesel engines, and three at Lima and Davenport, Okla., and Scammon, Kans., are electrically driven.

To increase the capacity of the system it was decided to install eight additional stations which are located, one at a point north of Sand Springs, Okla., others at Chetopa, Kans., Cole Camp and Centralia, Ma., Bayliss and Broadwell, Ill., which are all electrically driven, and the Diesel engine-driven plant at Sheldon, Mo., described above. In addition to these plants there is an electrically driven station at Fairbury, Ill.

The equipment in all of these new stations is larger than that used in the pump stations first installed. The electric motors are rated at 450 and 800 horsepower, while the Diesel engines are 600 horsepower each.

The maximum pressure at any point in the line is 750 pounds, but all stations are not required to carry such high pressure and some work on a pressure as low as 500 pounds.

This system now has a total of 19 stations (one is inactive). The Diesel stations are equipped with engines made by the McIntosh & Seymour Corp., Worthington Pump & Machinery Corp., and Busch Sulzer Co., while the pumps were made by Prescott Co., Goulds Pump Co., Wilson-Snyder Manufacturing Corp., and Worthington Pump & Machinery Corp.

The electric stations were equipped with machinery made by General Electric Co., Westinghouse Electric & Manufacturing Co., and Allis-Chalmers Manufacturing Co.

Suction pumps were built by the National Transit Pump & Machine Co. and the Diesel engine driven auxiliary units were furnished by Cooper-Bessemer Corp.

Photograph of interior of Sheldon, Mo., pipe line station of Texas-Empire Pipe Line Co.

Standard (N.J.) Has Large Lease Holdings In New Penn Gas Field

By A. E. Mockler

NEW YORK, Mar. 2.—Lycoming Natural Gas Co. of Delaware has been incorporated as a subsidiary of the Standard Oil Co. (New Jersey) and will hold and operate the New Jersey company's natural gas properties in Tioga County, Pennsylvania, and the surrounding territory.

Details concerning the plans of the Lycoming company are not yet available but it is believed that the company will extensively develop the natural gas production on its acreage. The Penn-United Pennsylvania Corp., an independent company, brought in a gas well with an estimated flow of 75,000,000 feet daily in Tioga County last week. This well is near the Standard's holdings. It is still blowing wild.

The headquarters of the Lycoming Natural Gas Co. are expected to be located in Pittsburgh, and while the officers of the new subsidiary have not yet been announced it is believed that the company will be under the direction of Christy Payne.

The Cities Service Co. has recently leased close to 500,000 acres of potential natural gas lands in Chumung County, New York, which is just northeast of Tioga County, Pennsylvania.

NORTH AND WEST TEXAS

(Continued from Page 70)

Mid-Continent Oil & Gas Co.'s No. 13 Lunghow, dry and abandoned, total depth 3,155 feet. Southern State Gas Co.'s No. 1 Case, abandoned location.

Hutchinson County

Huber Petroleum and Blaisdell's No. 1-A Johnson, top pay 2,235-2,615 feet, initial production 9,000,000 feet of gas, total depth 2,615 feet.

RUNS THROUGH TRUNK LINES

Company, size and location—	Bbls.
Atlantic, 10-inch, Houston	25,806
Gulf, 10-inch, Ranger	22,613
Humble, 2 and 8-inch, San Angelo	35,211
Humble, 10 and 12-inch, Comyn	48,457
Illinois, 2 and 8-inch, Del Rio	25,105
Magnolia, 8-inch, De Leon	26,164
Pasotex, 8-inch, El Paso	13,959
Shell, 10-inch, Healdton	27,588
Shell, 10-inch, Houston	28,050
Texas, 12-inch, Houston	31,382
Total	284,335

RUNS TO WEST TEXAS REFINERIES

Amarillo Ref. Co., Pyote	None
Big Spring Ref. Co., Big Spring	1,405
Burford Ref. Co., Pecos	3,918
Cosden Ref. Co., Big Spring	7,235
Col-Tex Ref. Co., Colorado	6,188
Humble Oil & Ref. Co., McCamey	14,974
Great Western Ref. Co., Big Spring	2,723
Tonkawa Ref. Co., Pyote	758
Wickett Ref. Co., Wickett	257
Total	37,458

TANK CAR SHIPMENTS

Big Lake, from Texon	3,000
Fox & Thorsen, from Mertzon	67
Santa Fe, from Hurdle	54
Southern Crude, from Wickett	15,030
Total	18,151
Total daily average distribution	339,944
Total daily average production	281,190
Daily average from storage	58,754

COMPLETIONS IN NORTH CENTRAL TEXAS

Archer County

Easter Oil Co. and Reynold's No. 1 Churchwell, top pay 1,164 feet, total depth 1,168 feet, plugged back to 1,167 feet, initial production 30 bbls. oil and 30 bbls. water. Krahenbuhl, Hutcherson and Bruner's No. 1 Hildebrand, top pay 1,155 feet, initial production 15 bbls. oil and 5 bbls. water, total depth 1,162 feet. E. J. Stump's No. 1 Wilson, dry and abandoned, total depth 1,575 feet. Marshall Hay's No. 1 Bearden, dry and abandoned, total depth 1,103 feet. E. B. Madden's No. 3 Richardson, dry and abandoned, total depth 1,219 feet. E. B. Madden's No. 4 Richardson, abandoned location.

Wilbarger County

Phillips Petroleum Co.'s No. 1-J Waggoner, temporarily abandoned, total depth 1,902 feet. Phillips Petroleum Co.'s No. 2-V Waggoner, temporarily abandoned, total depth 1,848 feet. Phillips Petroleum Co.'s No. 4-GG Waggoner, temporarily abandoned, total depth 2,275 feet.

Throckmorton County

Woodley Petroleum Co.'s No. 1 Brown, dry and abandoned, total depth 746 feet.

Young County

Ard and Deep Development Co.'s No. 1 Bullock, dry and abandoned, total depth 703 feet. Brazelton and others' No. 2 Belknap Cattle Co., dry and abandoned, total depth 753 feet. Cooper and others' No. 1 Carter and others, dry and abandoned, total depth 1,268 feet. W. B. Hamilton's No. 1 Jeffery, dry and abandoned, total depth 850 feet. W. B. Hamilton's No. 9 Finch estate, top pay 651 feet, total depth 676 feet, plugged back to 669 feet, initial production 50 bbls. W. S. Langford's No. 1 Hunt, dry and abandoned, total depth 810 feet. Pacific-Atlantic Oil Service Co.'s No. 1 Dyer, dry and abandoned, total depth 640 feet. Putnam Oil Co.'s No. 1 Tonton, dry and abandoned, total depth 812 feet. Victor Swanson's No. 1 Ligon, dry and abandoned, total depth 656 feet. The Texas Company and McKanna's No. 4-A Finch estate, top pay 654 feet, initial production 167 bbls., total depth 667 feet. The Texas Company and McKanna's No. 5-A Finch estate, top pay 655 feet, initial production 125 bbls., total depth 667 feet. The Texas Company and McKanna's No. 4-B Jeffery, top pay 743 feet, shot with 20 quarts, no results, dry and abandoned, total depth 787 feet. Vandivert and others' No. 1 Henning, dry and abandoned, total depth 906 feet. Wooten and Reed's No. 4 McBrayer, top pay 598 feet, initial production 7 bbls., total depth 626 feet.

COMPLETIONS IN RANGER DISTRICT

Brown County

W. G. Sawyer's No. 2 Carmichael, dry and abandoned, total depth 2,095 feet.

Callahan County

Guffey and others' No. 1 Finley, dry and abandoned, total depth 822 feet. John Victor's No. 1 Snyder, dry and abandoned, total depth 1,100 feet.

Coleman County

Prairie Oil & Gas Co.'s No. 3 Golson, top pay 1,565 feet, initial production 500 bbls., total depth 1,576 feet. Prairie Oil & Gas Co.'s No. 2 Golson, top pay 1,569 feet, initial production 105 bbls., total depth 1,586 feet.

NORTH TEXAS PRODUCTION
Week Ending February 28

Panhandle District—	Bbls.
Carson County	3,759
Hutchinson County	10,890
Gray County	37,925
Moore County	276
Potter County	..
Wheeler County	325
Total production this week	53,175
Total production last week	50,010
Increase	3,165
Wichita Falls District—	
Archer County	12,957
Baylor County	841
Clay County	632
Cooke County	2,179
Foard County	75
Jack County	726
Haskell County	29
Montague County	3,952
Throckmorton County	340
Wilbarger County	10,190
Wichita County	20,665
Young County	12,430
Total production this week	65,016
Total production last week	63,535
Increase	1,481
Ranger District—	
Brown County	3,756
Callahan County	1,494
Coleman County	1,378
Comanche County	717
Palo Pinto County	329
Eastland County	3,018
Shackelford County	3,908
Stephens County	4,651
Total production this week	19,251
Total production last week	19,163
Increase	88

FATALLY BURNED

PYOTE, Tex., Feb. 28.—H. R. Van Cleve, 35, who was burned in a refinery explosion on February 23, died at the Pecos Hospital two days later.

Personal Paragraphs About Oil Men

R. S. McKeon was recently re-elected secretary of the Italo Oil Company.

* * *

C. F. Cruciger, vice president, Spang, Chalfant & Company, Pittsburgh, Pa., was a recent visitor to Tulsa.

* * *

W. G. Skelly, president of the Skelly Oil Company, recently completed an inspection trip over the East Central Texas fields.

* * *

Fred P. Shayes, formerly with the Houston Oil Company and stationed at Beeville, Tex., is now with the United Gas Company at Houston, Tex.

* * *

W. W. Leach, geologist, has been stationed at Henderson, East Texas, by The Texas Company. He was until recently with the same company at San Antonio, Tex.

* * *

William Reinhardt, vice president of the Shell Oil Company, has resigned his executive position with that concern in order to become general manager of the Kettleman North Dome Association.

* * *

C. V. Millikan, Amerada Petroleum Corporation, Tulsa, chairman of the petroleum division of the American Institute of Mining and Metallurgical Engineers, has returned from the annual meeting of the Institute in New York.

* * *

Clarence M. Fuller, former president of the Richfield Oil Company of California, has become associated with the newly organized Magu Syndicate, which will drill a wildcat on acreage located approximately 10 miles east of Oxnard.

* * *

L. P. St. Clair, president of the Union Oil Company of California and George R. Daley, San Diego, Calif., banker, have been elected vice presidents of the Western Asphalt Association, which maintains offices in Los Angeles, Calif.

* * *

Frank McCarthy, formerly chief engineer of the Producers & Refiners Corporation, and later vice president and general manager of the Uinta Pipe Line Company, Salt Lake City, Utah, has assumed his duties as chief engineer of the Ohio Oil Company.

* * *

F. B. Ramey, of The Texas Company, was elected chairman of the Petroleum Group of the Atlanta Association of Credit Men, at the annual meeting of the association at Atlanta, Ga. J. L. Tedder, of Sinclair Refining Company, was elected vice chairman.

* * *

F. F. Hill, of the Union Oil Company, has been appointed director of production for the company. Simultaneously with this appointment, R. E. Haylett was selected director of manufacturing, and V. H. Kelly, director of sales, having charge of refined domestic and export sales, fuel and crude oil sales, including storage and operating facilities.

* * *

C. V. Lee, formerly vice president of the Taylor-Link Oil Company, San Angelo, Tex., has succeeded James L. Taylor as president. F. L. Bouknight, formerly secretary-treasurer, of Houston, Tex., was chosen as vice president. Bradley C. Phair, of Houston, succeeds Mr. Bouknight, and Miss Fay Kinsey, of San Angelo, is assistant secretary. The following directors were re-elected: C. V. Lee, James L. Taylor, F. L. Bouknight, Brandon Janes and H. E. L. Toomps.

* * *

Glenn Harroun, superintendent of field operations, in the production department for the Sinclair Oil & Gas Company who has had charge of the company's development program in the Oklahoma City Field, has also been placed in charge of the company's drilling operations in the East Texas area. Since the company's operations have slowed down in the Oklahoma City Field, Mr. Harroun expects to spend considerable time in the East Texas Field with headquarters at Fort Worth.

J. J. Curl, formerly operating out of San Antonio, Tex., has moved to Chicago.

* * *

Don T. Langan, Kansas City representative of the Youngstown Sheet & Tube Company, was a recent visitor to Tulsa.

* * *

Willard Miller, chief geologist for the W. R. Ramsey interests in Oklahoma, has been visiting the East Central Texas fields.

* * *

T. C. Ervin, superintendent of the boiler plant of the Lucey Manufacturing Corporation, has been spending several weeks in Mid-Continent oil fields studying boiler problems.

* * *

Kenneth Wickett, superintendent for the Barnsdall Oil Company, Tulsa, accompanied by Mrs. Wickett, has been making an inspection trip through the new fields of Rusk and Gregg Counties, Texas.

Men of the Industry

James R. Palmer

James R. Palmer, superintendent of the Cabin Creek, W. Va., refinery of the Pure Oil Company, was born in the mining town of Plymouth, Pa., in 1876, and worked in the mines for 10 years and then 10 years for the Chester (Pa.) Traction Company before he started in the oil refining business, where he was destined to rise rapidly. First he got a job as pipefitter's helper in the Marcus Hook, Pa., refinery of the Pure Oil Company in 1910. Six months later he was made a stillman's helper. On this job he received 20 cents an hour and worked 12 hours a day, putting in a full 24 hours every other Sunday. He soon was promoted to stillman, working the same number of hours as before, but with his wages increased to 25 cents an hour.

Mr. Palmer continued to work at the Marcus Hook refinery until 1918, when he was transferred to the Cabin Creek refinery as assistant to Superintendent J. J. Rheil. Upon the death of Mr. Rheil in 1923 Mr. Palmer was made superintendent.

Methods of refining have undergone great changes since Mr. Palmer entered the business 20 years ago. Cracking units were unknown in that day and all distillation was done in batch stills. Fractionating towers were just coming into use on coke stills. The stillman had to control all distillation by hand, guessing at still temperatures by noting heat changes in the firebox. Mr. Palmer thus knows refining from the ground up, having seen modern methods take the place of the primitive ones in use when he obtained his first refinery job.

Guy E. Scott, of the oil firm of Jenkins & Scott, Wichita, Kans., has moved to Longview, Tex.

* * *

Jay P. Walker, president of the National Tank Company, Tulsa, has returned from a trip to the East Central Texas fields.

* * *

J. E. Mabee, drilling contractor, is spending a good part of his time at Tyler and the East Texas fields, as is E. J. Gracie, general superintendent.

* * *

C. F. Russ, assistant superintendent of the Gulf Production Company, Houston, Tex., has been spending several days looking over the new fields in Rusk and Gregg Counties.

* * *

J. T. Beardsley, independent oil man, Farmington, N. Mex., has been spending some time at Houston, Tex., and in southern Texas visiting Gulf Coast operators and fields.

* * *

E. M. Converse, sales manager, Dearborn Chemical Company, Chicago, and active in chemical research work for the company, has returned from a combined business and pleasure trip to Cuba.

* * *

Henry Rogatz, geologist of the Phillips Petroleum Company in the Panhandle Field, has resigned and will enter Columbia University, New York, as a candidate for the doctor of geology degree.

* * *

Russell S. Knappen, Gypsy Oil Company, Tulsa, has returned from the annual meeting of the American Institute of Mining and Metallurgical Engineers in New York City, which he attended as delegate for the Mid-Continent section.

* * *

William H. McGunagle, who has been connected with the Tulsa office of the Oil Conservation Engineering Company, is now with Westcott & Greis, Inc., who have taken over the Tulsa office of the Oil Conservation Engineering Company.

* * *

A. C. Galbraith, who has been associated with the Union Oil Company of California for the past 15 years, has been elected assistant vice president of the company and managing director of the Atlantic Union Oil Company, Ltd., of Australasia.

* * *

William H. Geis, former vice president of the Continental Oil Company and later president of the Arrowhead Oil Company, has been appointed general superintendent of all properties of the Italo Petroleum Corporation of America and assistant to Clay Carpenter, receiver in equity.

* * *

R. E. Wertz, vice president; G. A. Stack, superintendent of the land department; and C. W. Wise, head of the Texas land department, of the Producers & Refiners Corporation, have returned from an inspection trip to the East Texas fields, and from a visit to the Hobbs Pool, New Mexico.

* * *

Robert R. Penn, chairman of the Texas Central Proration Committee, Dallas, Tex., spent a short time in Houston, Tex., conferring with operators there. He also was the principal speaker at a meeting of the Rotary Club during which he discussed the economic situation of the petroleum industry.

* * *

Superintendents of various companies who have been moved to the new producing areas in East Central Texas, include: Arthur Beeling, district superintendent for the Humble Oil & Refining Company, at Tyler; H. H. Taylor, and Joe Russell, superintendents for the Gulf Production Company; Glenn Harroun, Sinclair Oil & Gas Company, Tyler; Joe Lister and Jim Lowrie, Shell Petroleum Corporation; Emmett Wilson, Magnolia Petroleum Company. Mr. Barbour, superintendent for the Humble Oil & Refining Company, Kilgore; Mr. McQuarrie, chief engineer for the Shell Petroleum Corporation, Kilgore; Mr. Harmon, superintendent for the Stanolind Oil & Gas Company, Tyler; Mr. Wayland, general superintendent, and Mr. Jamison, superintendent for the Arkansas Fuel Oil Company, Longview.

Natural Gas Industry Developments

GAS UTILITY SALES SLIGHTLY LESS IN 1930

A slight decrease in gas utility sales for the 12 months ending December 31, 1930, is indicated by the comparative operating reports of manufactured and natural gas utilities to the statistical department of the American Gas Association. Reports from companies representing over 90 per cent of the manufactured gas industry indicate sales of 353,832,087,000 feet during 1930, compared with 354,268,765,000 feet during 1929, a decline of one-tenth of 1 per cent. The revenues totaled $376,885,239 compared with $376,682,611 during 1929. The declining trend in water gas production continued during 1930, production averaging nearly 5 per cent under the previous year. The quantities of coke oven gas produced and purchased increased 4.4 per cent.

Natural gas companies representing more than 85 per cent of the public utility distribution of natural gas report sales for the year in excess of 572,000,000,000 feet, a decrease of 1.4 per cent from the year 1929. The revenues of these companies aggregated $258,209,100 compared with $264,296,075 during the preceding year.

For comparison with other fuels, the production of bituminous coal during 1930 declined by nearly 14 per cent, anthracite coal production dropped more than 5 per cent, crude petroleum output was down 11 per cent, coke production down nearly 15 per cent, while the production of electric power declined by 1.8 per cent.

While final figures covering the entire production and consumption of natural gas during the year are not yet available, preliminary estimates indicate that production aggregated more than 1,940,000,000,000 feet, an increase of 1.1 per cent over the year 1929.

A significant feature of natural gas utilization is indicated by the fact that while the total production of electric power during 1930 declined by 1.8 per cent from the previous year, the use of natural gas for the generation of electric current revealed a marked increase. Consumption of all other fuels by the electric industry decreased considerably during the year, and the production of hydroelectric energy dropped 5.3 per cent, but the use of natural gas by electric utilities during 1930 increased 6.7 per cent as compared to the previous year.

OKLAHOMA GAS VOTES

Citizens of Garber, Okla., in an election February 18, authorized $27,000 in bonds for construction of a municipally owned natural gas transmission and distribution system in Garber. The Consolidated Gas Utilities Co., which holds the franchise here, has offered an adjustment of rates which, however, has not been passed upon by the city officials.

Citizens of Mulhall, Okla., granted a 25-year natural gas franchise to the Mulhall gas Co. by a vote of 102 to 35, recently. A part of the gas system had already been installed. The rates provide for a charge of 15 cents per 100 feet for the first 1,000 feet and 60 cents for each additional 1,000 feet.

H. E. Dowd Gas Co. has been granted a gas franchise by citizens of Porum, Okla., by a vote of 88 to 11. The company owns 20 leases near the city and plans to drill for gas. The franchise provides that the gas must be furnished by August 1.

BOISE CITY FRANCHISE VOTE

Citizens of Boise City, Okla., will vote March 7 on granting a natural gas franchise to the Cimarron Utilities Co. If the franchise is granted work will begin on the new system as soon as material can be assembled, according to C. R. Stahl, Borger, Tex., general manager of the company.

MUSKEGON CONSUMPTION LESS THAN MILLION FEET

MUSKEGON, Mich., Mar. 2.—Less than 1,000,000 feet of natural gas daily is being marketed from the Muskegon Field in contrast with a daily consumption of 18,000,000 feet at the peak production early in 1929.

The West Michigan Consumers Co., organized by the manufacturers of Greater Muskegon, has a daily sendout of about 700,000 feet and an available supply of about 1,200,000 feet. The other 500,000 feet is going into the air nights since all wells must be produced and there is no market. Practically all of the natural gas available is casinghead gas.

The Muskegon Pipe Line Co. has a daily sendout of about 100,000 feet, principally casinghead gas with some dry gas from a Monroe formation well of the Shoup Oil & Gas Co. The Continental Motors Corp.'s line is handling less than 200,000 feet.

Natural gas is now bringing about 20 cents per 1,000 feet at the well. This price has been paid for recently discovered Monroe gas.

A total of 377,500,000 feet, mostly natural gas, was sold during 1930 by the Muskegon Gas Co., which changed back to artificial gas on December 17, 1930, according to the annual report. The company paid 18 cents per 1,000 feet at the well, or 50 per cent more than in 1929 when gas was purchased at 12 cents from the operators. The company spent $225,000 during 1930 for plant extension and will spend $100,000 in 1931, $50,000 for further plant improvements and $50,000 for extension of mains, meters and services. Officers elected were: President and general manager, D. A. Powell, of Muskegon; vice presidents, R. B. Brown of Chicago, head of the American Light & Traction Co.; W. E. Thornton, Muskegon; James Lawrence, Chicago; and secretary-treasurer, G. J. Zorn, of Muskegon.

GAS METER SHORT COURSE

The eighth Southwestern Gas Measurement Short Course, to be held at the Engineering Building, University of Oklahoma, in Norman, Okla., April 21, 22 and 23, will be the best yet held, according to Prof. W. H. Carson of the College of Engineering, director of the course. The program committee held its final meeting on February 17 and the program arranged is being printed for distribution to companies and individuals interested. The enrollment has increased from 60 in 1924 to about 450 in 1930, last year's registration including representatives from 22 states and two foreign countries.

COAST COUNTIES GAS

At the annual meeting of the Coast Counties Gas & Electric Co. the following officers were elected: J. B. Wilson, president; R. W. Hanna, vice president; E. F. English, vice president; R. N. Dreiman, secretary and treasurer; B. W. Letcher, assistant secretary; H. M. Whitely, assistant secretary; V. F. Palmer, assistant treasurer; C. E. Braun, assistant treasurer; D. A. McCullough, assistant treasurer. The board of directors follows: W. H. Berg, Earle Derby, R. N. Dreiman, E. F. English, R. W. Hanna, J MacPherson, Oscar Sutro, J. H. Tuttle and J. B. Wilson.

C. Y. WELLES DIES

Clifford Yale Welles, aged 51, engineer and land man employed by Lone Star Gas Co. of Dallas, Tex., died recently after a long illness. He was born at Hartford, Conn., in 1879 and was in the employ of the Lone Star Gas Co. for more than 15 years.

CANADA TO CONTINUE ITS RESEARCH ON GAS

CHATHAM, Ontario, Feb. 28.—Utilization of the waste gas of Turner Valley was discussed at a meeting of the National Research Council's associate committee on gas research, held at Edmonton. Dr. H. M. Tory presided and those present included Dr. R. C. Wallace, president of the University of Alberta; Dr. E. H. Boomer, Professor Stansfield of the Alberta Research Council; P. V. Rosewarne of the federal mines department, and Dr. G. S. Witby and F. E. Lathe of the National Research Council. Reports were presented on all departments of research work in connection with natural gas, and future plans were discussed.

The necessity for finding new uses for Turner Valley waste gas has become increasingly urgent owing to the increase in oil production the past season.

Doctor Boomer's report on his work on the hydrogenation of McMurray bitumen showed that in recent experiments he had secured yields of 60 to 70 per cent of the weight of the bitumen in gasoline, this being far in excess of percentages previously reported. By a simple heat treatment of natural gas in an appropriate apparatus, Doctor Boomer reported he has produced benzene in sufficient yield to suggest commercial possibilities. The committee favored an increase in the scale of the experiments to a point where sufficiently large quantities of Turner Valley gas would be available to secure reliable data on yields and costs.

Analyses of natural gases for helium content were presented by P. V. Rosewarne. These showed that the Turner Valley gas contained only a minute percentage of helium, far too low for commercial production; and while the Bow Island gas had a larger helium content, even this was much below that of newer fields in the United States. Further investigation into the possibilities of helium production in Canada was considered necessary. Mr. Rosewarne also presented complete analyses of gases from a number of Turner Valley wells, and data on the composition of naphtha as it comes from the separators and as it is delivered to the refiners. The comparative data indicated a considerable loss of liquefiable fuel subsequent to separation of the naphtha.

Doctor Witby reported on the work done by Doctor Cambron and his staff in the National Research laboratories at Ottawa. This work has aimed at a processing of the gas to give a material for the manufacture of a group of chemicals, of which industrial alcohol was the most important. It was believed that the results were far in advance, in respect of yields and costs, of those obtained in any work of a similar character. The possibility was indicated of securing as much as 2 gallons of industrial alcohol from 1,000 feet of gas at a cost sufficiently low to be within the realm of economic possibilities.

Viewed as a whole, the work of the year showed such substantial progress that it was decided to continue the investigations as rapidly as arrangements could be made.

NEW COMPRESSOR READY

Mild weather has restricted consumption of natural gas and made it unnecessary to put into operation the new $50,000 gas compressor station of the Southwestern Light & Power Co., 4 miles west of Agawam, Okla. This plant was recently completed and takes gas from the Chickasha Field at 70 pounds pressure and sends it into the line to Chickasha at a pressure of 225 pounds. The plant was formally opened recently. It will enable the company to give Chickasha and vicinity adequate gas pressure during the coldest weather.

SLIDING SCALE CUT IN SAN ANTONIO GAS

SAN ANTONIO, Tex., Feb. 28.—A sliding scale reduction in gas rates, effective March 1, was announced by the San Antonio Public Service Co. through Col. W. B. Tuttle, president. A saving of from 6 to 10 per cent for each customer is predicted, and the total saving to the city will be about $80,000.

The new rates become effective after March 1 and are available at once for customers who sign a one-year contract. Customers whose gas bill is more than $2.95 a month come within the rate cut.

"Gas rates now in effect in San Antonio are lower than those in most other Texas cities for customers using less than $2.50 in gas a month," Colonel Tuttle said.

The new rates follow: Minimum bill of $1.08 net ($1.20 gross), includes use of 700 feet of gas; next 19,300 feet at 67½ cents a thousand net (75 cents gross); next 10,000 feet at 63 cents a thousand net (70 cents gross); next 20,000 feet at 58½ cents a thousand net (65 cents gross); and all over 50,000 feet at 49½ cents a thousand net (55 cents gross).

The average amount of gas used by domestic customers last December and January was 7,000 feet a month, Colonel Tuttle said, which under the existing open rate costs $5.62. Under the new rate the bill would be $5.34, a 6 per cent reduction. Customers using 10,000 feet of gas a month under the existing open rate would pay $7.92 and under the new rate $7.36, an 8 per cent reduction. A customer using 50,000 feet a month under the old rate would pay $35.82 and under the new rate $32.11, a 10 per cent saving.

OKLAHOMA UTILITIES MEETING

Experts in their particular activities are scheduled to address sessions of the Oklahoma Utilities Association's thirteenth annual convention in Oklahoma City, March 10 and 11. Prominent among them will be S. A. Lipscombe of the Arkansas Natural Gas Co., Little Rock; H. A. Atwater, Kansas City, Combustion Equipment Co.; O. M. Setrum, Detroit, Mich., manager of the Philfuels Co.; E. C. Cortelyou, Bartlesville, Cities Service Gas Co.; J. F. Orr, Houston, Tex., commercial manager, United Gas System; W. A. Jones, New York, president of the National Electric Light Association, and J. F. Owens, Oklahoma City, vice president of the same organization.

GUTHRIE MAY CANCEL VOTE

Guthrie, Okla., will abandon its project to construct a municipally owned natural gas distribution system if proposals are adopted, which will be submitted to citizens in a special election called for March 23. On that date proposals will be submitted to cancel the $225,000 bond issue voted last June and to grant a gas franchise to the Western Service Corp. of Oklahoma City, of which Earl R. Ernsberger is president and general manager. Validity of the Guthrie municipal gas bonds is questioned in a suit now pending in the Oklahoma Supreme Court.

ARKANSAS GAS INVESTIGATION

SHREVEPORT, La., Mar. 2.—Alleging statewide complaints on the size of gas bills a resolution (No. 23 by Mr. Stewart) has been adopted by the Arkansas senate ordering an investigation "as to the quality of gas being furnished consumers in Arkansas, the price paid for same . . . . to determine whether or not the gas being furnished is equal to 950 B.t.u. per foot." A committee to conduct the inquiry is to report in 10 days.

ONE PIECE BODY CASTINGS

AVOID EXTERNAL LEAKS AND SEEPAGE

EMCO large capacity positive meters have 15 years' successful performance behind them. Eminent gas engineers have voluntarily shown us results of independent tests in which the EMCOS, with 10,000 cu. ft. per hour capacity, have accurately measured down to 10 cu. ft. per hour.

Design of EMCO body castings assures freedom from leaks and is inherently stronger than any body requiring side plates held in place by bolts. Our design requires only one-third as many bolts or cap screws, which reduces labor, and eliminates gasket trouble. It avoids seepage troubles when used with manufactured gas.

The body design is exclusive with us. And so is the valve plate, which makes it possible to put an EMCO in a pit or against a wall, and still have all internal parts accessible. Repairs or inspection can be made without removing the meter body from the line, which is impossible with competing meters. There are more EMCO Large Capacity positive meters in use than all other makes combined. They are built in the largest gas meter factory in the world.

10 reasons why EMCOS are better

1. Past Performance.
2. Engineering Design.
3. Free from leaks.
4. 66% less bolts and cap screws.
5. Reduces labor.
6. Eliminates gasket troubles.
7. Avoids seepage.
8. Accessible.
9. Repair or inspection made with meter in line.
10. There are more EMCO Large Capacity Positive Meters in use than all other makes combined.

PITTSBURGH EQUITABLE METER COMPANY

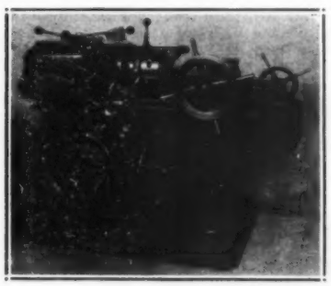
Main Office and Works—Pittsburgh, Pa.

New York City, Chicago, Ill., Tulsa, Okla., Dallas, Texas, Columbia, S. C., Salt Lake City, Davenport, Iowa, Seattle, Wash., Houston, Texas, Los Angeles, Calif., Kansas City, Mo.

Oil Industry Equipment and Supplies

LANDMACO THREADER HAS VALUABLE NEW FEATURES

The Landis Machine Co., Inc., Waynesboro, Pa., has placed on the market its Landmaco threading machine, of new design, characterized by strength, rigidity, wearing qualities and a capacity for producing accurate screw threads. The machine is made in the single and double-head models, equipped with heat-treated



and ground Lanco heads. It has a single-pulley drive with a friction clutch to start and stop the machine. The adjustable clutch, mounted on the outer end of the main drive shaft, is readily accessible.

The gear box is of the selective type and has eight speeds, making possible the use of an efficient threading speed on all materials and for all diameters within the capacity of the machine. The gear box is integral with the headstock and is fitted throughout with antifriction bearings. The gears, made of hardened and burnished chrome-nickel steel, are mounted on heat-treated alloy-steel shafts. Speed changes are effected through convenient levers. The bearings and all gears are lubricated automatically by a flood system.

The double-head machines, when equipped with lead screws, have a reversing mechanism in the gear box for reversing one spindle. This mechanism can be supplied with the nonlead screw machines.

The spindle is driven by spiral bevel gears. The bearings at the die head end are exceptionally large and are preloaded. This type of bearing eliminates the end play which otherwise would develop through wear.

The die head is placed close to the front spindle bearing to reduce the overhang to a minimum. The head is opened through a yoke by the forward movement of the carriage and is closed as the carriage is withdrawn. The yoke also has a lever by which the die head may be opened or closed by hand.

The carriage is gibbed and is operated either by a rack and pinion or a lever. The guides, protected by guards and wipers, are attached to the front of the carriage and pass under the headstock. The wipers, at the rear end of the carriage, are adjustable for wear. The guides are lubricated automatically by felt pads in the base of the carriage and fed from a central oil reservoir.

The vise has a horizontal sidewise as well as vertical adjustment, distinctive of Landis machines and makes possible an extremely accurate alignment between the die heard and the work. The heavy rim of the vise hand wheel acts as a flywheel and reduces the effort required to grip the work. The vise jaws are driven by renewable bronze vise screw nuts.

The low-pressure gear-type pump is connected directly to the constant speed shaft in the gear box and will reverse automatically when the machine is reversed. It is built into the bed and can be removed for inspection without disconnecting any piping.

The bed, of semisteel, is cast in one piece. It is reinforced by an inner wall and forms a rigid support for the carriage and headstock. Large drains below the guides and also at the base of the bed return the cutting coolant overflow to the reservoir.

The lead screw, which is optional, is located centrally between the guides of the machine and takes the thrust load without binding the carriage. It is mounted on large preloaded ball bearings which automatically eliminate end play. The lead screw has a coarse pitch thread with a rounded crest. This design not only facilitates the engagement of the nut, but greatly increases the life of the unit. The lead screw is enclosed in a steel tube to protect it from chips and dirt.

The lead screw nut is of the split full-nut type and is made of bronze. The two segments, each equivalent to a half-nut, are exceptionally long to increase their life. The lead screw nut has direct contact with and takes the thrust load of the carriage, relieving the carrier of strain. A third adjustable half-nut, also of bronze, is employed to take up the backlash. The contact surfaces of the lead screw and nut are lubricated automatically from a reservoir in the carriage. The supply is controlled by filtering the oil through a wooden plug in the lead-screw nut.

The pitch change gears are housed in a gear box located at the headstock end of the machine. The intermediate gears are carried in a circular slot in the base of the gear box. This construction insures a rigid support for the entire gear train.

The machine, when arranged for motor drive, has the motor mounted in a compartment in the bed and connected to the main drive shaft by a silent chain.

NOTES ABOUT TRADE LITERATURE

Additions to its loose-leaf catalog have been sent out by the General Electric Co., Schenectady, N. Y., covering totally enclosed, fan-cooled induction motors, manually operated field switches, the G-E thermostat, brazing equipment, and an automatic tank and pipe welder.

The Kewanee Boiler Corp., Kewanee, Ill., has issued an illustrated 32-page booklet in colors describing Kewanee fire-box boilers.

A condensed listing of equipment for pipe line, oil field, ditching, hauling, highway work and general contracting, has been issued by the Resistcor Engineering Corp., Tulsa.

"Engineering Achievements in 1930" are recounted in a 40-page booklet being mailed by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

The Aluminum Co. of America, Pittsburgh, Pa., has published a 90-page booklet devoted to "Alcoa Aluminum for Truck Bodies."

The International Nickel Co., New York, is distributing lists of publications on nickel and its alloys of interest to the oil and other industries.

"Interlocking Control" is the title of Bulletin No. 9, issued by the engineering development department of the Brown Instrument Co., Philadelphia, Pa., for the refining branch of the oil industry.

"Truscon" is the name of a new "graphic monthly devoted to construction, maintenance and steel products," published by the Truscon Steel Co., Youngstown, Ohio. The first number, a 16-page publication, illustrates and describes Truscon products and structures in which they have been used.

Two bulletins have been prepared by the Superior Engine Co., Springfield, Ohio, on the Superior stationary Diesel engines types VDM and VDH, which are vertical, four-cycle and cold-starting. One, Bulletin 120, contains 16 pages and describes these engines in detail. The other, Bulletin 121, of four pages, presents information in condensed form.

A clever broadside, "Who'll I charge this steam to?" distributed by the Brown Instrument Co., Philadelphia, Pa., is designed to stir interest in the Brown electric flow meter, which shows just how many pounds of steam, gallons of water, barrels of oil or cubic feet of air or gas were delivered during any specified time

A beautifully printed 16-page booklet in colors published by the American Asphalt Paint Co., 844 Rush Street, Chicago, tells comprehensively the story of Gilsonite asphalt.

"Back of the Mack" is the title of a 20-page booklet issued by Mack Trucks, Inc., New York, presenting the history of the Mack company.

The Sperry-Sun Well Surveying Co., Philadelphia, Pa., is sending out two bulletins, one on Surwell service and the other on the Syfo Clinograph.

A bulletin issued by Oliver United Filters, Inc., New York, describes, with pictures, vacuum filtration with Oliver United filters.

The Young Radiator Co., Racine, Wis., has published a new booklet, No. H-1,230, describing its complete line of unit heaters suitable for heating small rooms to the largest buildings and factories, with special equipment for garages, warehouses and airplane hangars.

The Bailey-Becker Co., Tulsa, distributor for the R-F Electrical Manufacturing Co., is mailing bulletins on the Keister turbine grinder and the Frost vertical turbine generator.

"More Profits in Clutch Replacements" is the title of a 24-page booklet published by the Associated Clutch Plate Manufacturers, Daily News Building, Chicago, and explaining why old clutch plates should not be relined.

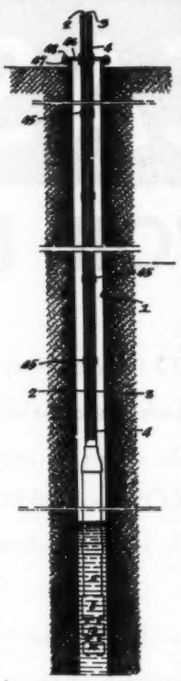
A new bulletin prepared by the Neilan Co., Ltd., Los Angeles, Calif., describes the Neilan remote manual control system, which the company says goes far in enabling engineers to approach their dream of one-man plants.

The E. J. Longyear Co., Minneapolis, Minn., has printed a catalog of unusual attractiveness describing and illustrating Longyear diamond core drills and supplies.

The Roots-Connersville-Wilbraham division of the Stacey Engineering Co. has issued two new bulletins, 21-B10 and 21-B11, covering the new line of Victor-Acme blowers. In combining the Victor and Acme lines, a wider range of capacities is offered. Two new types, the "AF" (antifriction bearing) and "AFS" (antifriction bearing and hardened steel gear) blowers have also been added and are explained in the bulletins.

PUMP WITHOUT RODS OR WASHERS IS ANNOUNCED

A method of pumping wells without the use of rods or washers has been invented by John Liming, Jr., of Philadelphia, Pa., and a patent has been issued to him. The pump has been tested by oil companies in Texas and Arkansas fields and it is said to have proved satisfactory in both the matter of production costs and the matter of simplicity of the device itself.



1, Casing; 2-3, pressure ducts; 4, carrier pipe; 5, top of pump chamber; 8, 13 and 14, valve chambers; 46, 47 and 48, flange on top of casing.

The pump is of pressure-type construction, with all moving parts on the derrick floor and no frictional moving parts in the hole. It has three valve chambers at the bottom of the well and is a long-stroke, double-acting, automatic deep well pump. The length of the stroke is determined by the amount of oil in the hole.

This pump cannot be termed a "jet pump" as it operates on a double-acting displacement principle, which the inventor says will double the production of a well capable of producing 1,500 bbls. per day. It is not affected by sand or other foreign matter and has automatic control at the ground surface.

At Goose Creek, Tex., a well making sand and 30 to 40 per cent water pumped over 600 bbls. in 30 days. The pump at the end of this time is reported to have shown no wear and could have been kept on the well indefinitely.

The volume of air used is sealed in the compressor, this being a special closed-type, two-stage machine, using this pressure for the alternate strokes of the pump and not exhausting into the atmosphere, thus showing a considerable saving. Where natural gas in the field is obtainable of sufficient pressure, no compressor is needed, the pump then being controlled by an automatic valve at the surface.

FOREIGN DISTRIBUTORS NAMED

The Fluid Packed Pump Co. has entered into a contract with Malopolska, a large holding company governing more than 50 per cent of the production of Poland, by which the latter will use stock and distribute Fluid Packed pumps under certain conditions throughout the Polish oil fields. The contract is the result of tests recently conducted by one of the companies in the Malopolska group. Much Polish production is effected by swabbing, owing to the high paraffin content of the oil. The Fluid Packed Pump Co. is said to have demonstrated that these wells could be pumped satisfactorily. The company also has entered into an agreement under which Soc. Apex S.A. will stock and distribute Fluid Packed pumps in the oil fields of Rumania. Stocks are being carried in Ploesti.

Let's Get Back to Bearing Fundamentals

A series of advertisements reviewing modern necessities in anti-friction bearing performance.

TIMKEN BEARING EQUIPPED

No. 4

Anti-Friction Bearings Should Be Able to Carry *Thrust* Loads as Well as *Radial* Loads

In practically every type of modern machinery, anti-friction bearings are called upon to carry both *radial* and *thrust* loads, and they should possess the inherent ability to do so—with full anti-friction efficiency.

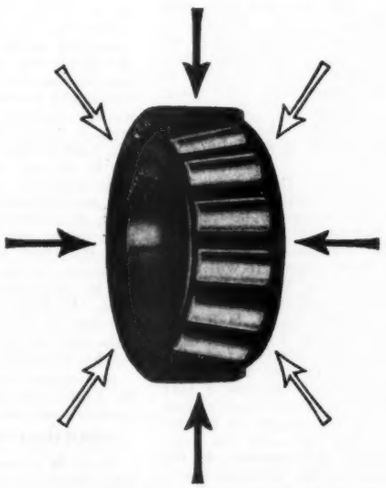
Timken Bearings are real *dual duty* bearings, combining the ability to carry *radial* loads, *thrust* loads or both together in any combination.

The reason is found in Timken *tapered* construction.

Anti-friction efficiency is practically 100% under all conditions.

When Timkens are used, no additional special thrust bearings, washers, or other devices are needed to take thrust loads—no matter how severe these may be.

The simple, sure, compact principle of Timken tapered construction insures perfect radial-thrust performance in all types of machines under all operating conditions. The Timken Roller Bearing Company, Canton, Ohio.



Timken Bearings Carry All Loads From All Directions

TIMKEN *Tapered Roller* **BEARINGS**

Will Pay Monthly for Eastern Oil Run

Thirty-two Completions During Week but There Were No Large Wells. Five Oil Completions in West Virginia

By Staff Correspondent

PITTSBURGH, Pa., Mar. 2.—In order to centralize the buying of credit balances of Buckeye and Corning grades of crude in the Buckeye Pipe Line Co., the South Penn Oil Co. discontinued the purchase of these crudes at all other offices of the company, excepting the Pittsburgh office, effective March 1, 1931. To continue as purchasers, this company has mailed to all producers and royalty owners, a standing order in blank, which when signed, authorizes the Buckeye Pipe Line Co. to transfer to the South Penn Oil Co. all crude as run from time to time, subject to the usual pipe line regulations. This order may be cancelled by either the purchaser or seller upon the receipt of proper notice.

Payment for the oil will be the usual posted price and settlement will be made on or before the twenty-fifth of each month for oil run from the first to the fifteenth and on or before the tenth day of each month for the second half of the month.

This standing order will not cover any credit balances in the pipe line prior to March 1, but only such oil as run after that date. Such accumulated credit balances prior to March 1 may be offered in the usual way to the South Penn Oil Co. and will be purchased by them as rapidly as the current outlet permits.

This plan is the forerunner of similar plans which will be put in operation later in other districts and fields where the South Penn Oil Co. is represented as a purchaser of crudes, and follows closely the modern established practice of the larger units of the oil industry. It gives to the producer a market for his oil at the price, which the law of supply and demand regulates, and to the purchaser a definite idea of the amount of crude which is to be available each month.

Thirty-two Completions

There are 32 wells completed in the three districts of the lower eastern fields during the past week. With the exception of one gasser in southeast Ohio there were no large wells, but the usual number of average gas wells in well defined territory. Since the advent of the Tioga gas strike, in the upper district of Pennsylvania, which now boasts of a 65,000,000-foot untamed gasser, and a second 22,000,000-foot gas well, most of the attention has been diverted northwards to the drilling in the Oriskany sand, which in the lower districts is badly faulted by structural upheavals.

Matching the Federal Oil Conservation Board's curtailment program, there have been few sizable oil wells completed in recent weeks, and the initial production from new wells has dropped sharply. In the past week from a total of 32 completions, there were but 11 oil producers, with an initial flow of but 93 bbls. The remainder were 15 gas wells and 6 dry holes.

SOUTHEAST OHIO

In southeast Ohio, in Falls Township, Muskingum County, the Atha Oil Co. completed a third well on the W. H. Atha farm in the Clinton sand at a depth of 3,560 feet. It is showing for over 4,000,000 feet a day. Another gasser was the test of the Preston Oil Co. on the George M. Oxley farm of 71½ acres in the NE Section 25, Perry Township, Coshocton County. It is showing for 500,000 feet a day from the Clinton sand at 3,070 feet.

Except for the shallow sand drilling in Medina County, the other completions were small. Near Albany, Section 20, Alexander Township, Athens County, Park Bowser and others completed a test on the G. W. Riley farm in the grit sand at 1,244 feet. It was a dry hole. In Jefferson County, a local syndicate drilled a second well on the D. S. Carr farm in the NW Section 9, Island Creek Township. It was also a dry hole and at a depth of 1,400 feet in the Berea sand.

There were five completions in Chatham Township, Medina County, all in the shallow Cow Run and Buell Run sands. On Lot 6, Section 16, the Preston Oil Co. drilled No. 13 on the E. T. and A. R. Clapp farm to a depth of 448 feet. It made 25 bbls. the first day after shot. On Lot 20, Section 16, E. R. Edson & Son Co. completed No. 12 on the M. A. and Eva Franks farm to a depth of 470 feet which produced 25 bbls. the first 24 hours after shot. The same operators drilled No. 14 on the George W. Packard farm, Lot 4, Section 13, to a depth of 465 feet. It was a dry hole. The Oko Oil & Gas Co. drilled No. 13 on the Steve and Anna Jelencsics farm, Lot 2, Section 12, in the Cow Run sand at a depth of 338 feet. It is showing for an 8-bbl. pumper after shot. On Lot 2, Section 4, C. L. Williams drilled a second test on the C. G. Chapman farm on the second Cow Run sand at 436 feet and it is a small half-barrel pumper.

In Washington County, John T. Clarey and others completed a second test on the Jacob Morningstar farm near Whipple Run, Lot 134, Fearing Township. It is a 5-bbl. producer after being shot in the Buell Run sand at a depth of 622 feet.

Drilling in Ohio

The deep test of Benedum and Trees on the Wayne Coal Co. tract in Island Creek Township, Jefferson County, has reached 3,500 feet and is approaching the Clinton sand. This test is scheduled to be drilling to 6,000 feet, or deeper, unless interrupted by production. In Section 23, same township, Peters & Co. have spudded in and started drilling on the James Clark farm.

In Athens County, there are several tests drilling. A. H. Heisey & Co. are down to 800 feet on the Charles E. Chase farm, Section 8, Alexander Township, and Smithenberger and others have reached 200 feet on the D. King farm. In Carthage Township, the Shade River Oil & Gas Co. is drilling on the F. W. Chapman farm, Section 26, at 450 feet. In Canaan Township, Nezum and others are at 400 feet on the Augustus Brechtel farm, Section 3. In Lee Township, the Letonia Oil & Gas Co. has started drilling on the Dave Bratton farm, Section 19. In York Township, where several fairly large gassers have been brought in, the Union Drilling & Producing Co. is at 1,200 feet in a second test on the W. H. Powell farm, Section 23, and Jack Walters is down to 2,600 feet on the Nelsonville Foundry Co. lot.

In Muskingum County, the Fritz Oil Co. has reached the top of the Clinton sand at 3,900 feet on the R. G. Fletcher farm in Section 4, Brush Creek Township. The well is shut down pending a change in ownership. In Section 3 of the same township, the same operators are at 1,800 feet on the B. F. Boyd farm. In Hopewell Township, the Preston Oil Co. is down to 2,950 feet on the M. Leasure farm in Section 6. In Wayne Township, the Preston Oil Co. is at 1,550 feet on the Ed Frick farm, Section 9, and the Atha Oil Co. at 2,700 feet on the J. B. Corbin farm, Section 3. In Washington Township, the Preston Oil Co. has reached 2,500 feet on the B. F. Slack farm, and the Wilson Brothers' rig on their own property is still idle. In Perry Township, the Preston Oil Co. has a rig standing on the John C. Hicks farm in Section 16.

WEST VIRGINIA

There were five oil wells completed in West Virginia and the largest was a 15-bbl. producer. In Clay district, Monongalia County, the South Penn Oil Co. completed a second well on the A. E. Tennant farm in the Fifth sand at 3,361 feet. It started off at 15 bbls. Near Mount Zion Church, on the waters of Dutchman Run, Murphy district, Ritchie County, Joshua Haught drilled a second test on his own farm at 1,925 feet in the Salt sand. It will make a 5-bbl. pumper. On the bank of Three Mile Creek, Sheridan district, Calhoun County, the Richter Oil Co. completed No. 5 on the Elmer Haught farm in the Salt sand at 1,960 feet and it is rated as a 2-bbl. well.

In Harrison County, the Furner Oil Co. drilled No. 8 on the John Furner farm, Ten Mile district, to a depth of 2,996 feet and in the Fifth sand. It is showing for a 2-bbl. pumper. In Center district, Wetzel County, Wade, Carney and others drilled a test on the J. T. Lemaster farm in a stray sand and completed it at 2,990 feet. The sand was found between 2,958-70 feet, with oil showing between 1,960-2,968 feet. The well is rated at 4 bbls. a day.

Gas Wells

In Cabell County, on the waters of Kilgore Creek, Grant district, W. H. Kirtley & Co. completed a test on the John Sunderland farm in the Berea sand and have a 250,000-foot gasser. On Indian Fork, in the same district, the Larner Gas Co. completed its No. 85 on the Nide Hanley farm in the brown shale. It is a 100,000-foot gas well. On the waters of Mud River, Barboursville district, Cabell County, the Hamilton Gas Co. drilled its No. 14 on the C. C. Clark farm in the brown shale and has a showing for 150,000 feet.

In Boone County, the Winifrede Co. drilled No. 7 on its own property in Sherman district to a depth of 3,607 feet and has a small gasser. Extending into Kanawha County, the same operators completed Nos. 11 and 13 on the same tract. No. 11 was completed in the Big Lime sand at 1,391 feet and it is good for over 500,000 feet a day. No. 13 was drilled to a depth of 1,760 feet and in the Weir sand and is also a fair gasser. Both wells lie in Cabin Creek district. In Louden district, Cunningham and Canterbury drilled a test on the O. M. Canterbury farm to a depth of 1,740 feet and the Weir sand, which is good for over 100,000 feet a day.

In Calhoun County, there were four completions, mostly small. In Sheridan district, the Conservation Oil & Gas Co. completed a test of an old well drilled deeper to 2,551 feet in the Berea sand on the James Kirby farm. It will make a small gas well. In Washington district, Doctor Hively and others completed their test on the William M. Hall heirs farm in the Salt sand at a depth of 1,556 feet. It is less than 100,000 feet, and has not been shot. In Lee district, the United Fuel Gas Co. completed a very light gas well on the Carr Shaffer farm No. 4,280, which was drilled in the Injun sand at 2,225 feet. In the same district, the Hope Construction & Refining Co. completed No. 7,514 on the C. C. Starcher farm in the Injun sand and at a depth of 2,276 feet. It had a show of gas but will be abandoned.

In Lincoln County, Louis R. Sweetland drilled a test on the J. T. Hoskinson farm in Carrol district to a depth of 2,385 feet. It is a small gas well natural and is now being cleaned out after shot, with no report of the gauge. In Marshall County, the Owens Illinois Glass Co. drilled a second well on the H. L. Tennant farm in Paw Paw district in the 50-foot sand at 2,387 feet. It will make a small gasser.

There were two other completions in Wetzel County. In Church district, Null and Morehead completed a test on the F. C. Shidell farm at a depth of 3,040 feet and have a gas well. In Magnolia district, R. V. Hennen, trustee drilled a test on the D. M. Alexander farm to 2,950 feet or the Gordon sand and found it dry.

Drilling in West Virginia

In Calhoun County there are still many tests drilling. In Washington district, Wiseman and Jackson have a rig standing on the Elizabeth J. Boothe farm, and George W. Hamilton and others are down to 1,400 feet on the Ella Eisman farm. Godfrey L. Cabot is drilling on the G B. May farm at 1,750 feet. In Sherman district, the Hope Natural Gas Co. is building a rig on the Ella Shaffer farm, and C. B. Lewis and others have part of the material on the ground for a test on the B. E. Summers farm. L. P. Bickel has reached 1,425 feet on the Jack Bland farm, and the Mid-Penn Oil Co. is at 700 feet on the Chess Poling farm. In Lee district, Ed Smith and others have spudded in and started drilling on the John Evans farm, and F. F. McIntosh has the materials on the ground for No. 3 on the Fox and Morgan lease. In Center district, B. J. Crawley has started his test on the Florence Pell farm, and Creed Barker has a rig up on the St. Paul Church lot. Park Bowser is building a rig for a second test on the W. H. Jackson farm, and on the T. J. Jackson farm the Hope Natural Gas Co. is down to 2,165 feet in its old No. 5,225 which is being drilled deeper. The United Fuel Gas Co. is building a rig on the Tell McDonald farm. Godfrey L. Cabot has made a location for No. 3 on the Scott Umstead farm, and W. H. Bickel for No. 4 on the John D. Collins farm. In Sheridan district, the Hope Natural Gas Co. is drilling deeper No. 5,029 on the J. N. Bell farm.

In Roane County, the deep test on the J. M. Hinzman farm in Curtis district being drilled by the United Fuel Gas Co. is drilling at 5,560 feet. In the same district, the Parsons Oil & Gas Co. is at 1,050 feet on the E. E. Rader farm, and the Reedy Oil & Gas Co. has made a location on the A. J. Paugh farm. In Smithfield district, Wiseman and Jackson have shut down on the McQuain heirs farm at 1,710 feet with a bad hole, and the United Fuel Gas Co. has a fishing job in its well on the Presley Vineyard farm which is being drilled deeper and had reached 5,005 feet. In Spencer district, Paul Weekley and others are rigging up on the Gay M. Sargent farm, and the Ohio Valley Gas Co. has the materials on the lot for No. 15 on the R. M. Jennings farm. In Reedy district, the Heck Oil Co. has abandoned location for No. 6 on the J. W. Conley farm, and has the materials on the ground for No. 5 on the H. W. Allen farm.

In McComas district, Cabell County, R. H. Adkins and others are moving in the materials on the R. W. Morris farm.

SOUTHWEST PENNSYLVANIA

Work is progressing slowly in southwest Pennsylvania, and the week resulted in but two completions. In Harmar Township, Allegheny County, Jesse H. Morrow and others drilled a second well on the Hugh Campbell heirs farm to a depth of 1,700 feet and in the 100-foot sand. It is showing for a 1-bbl. pumper. Nearby, the Chemical Oil & Gas Co.'s No. 1 was good for 60 bbls. initial and settled down to 25 bbls. a week. This district is notoriously spotty. In Hopewell Township, Beaver County, Edward McCoy drilled a test on his own property to a depth of 1,700 feet and it is a dry hole.

In Donegal Township, Washington County, M. Green & Co. are building a rig on the John Craig farm.

Oil Industry Equipment and Supplies

SURFACE CONTACT MARKS PITTER ONE-WAY CLUTCH

The Pitter one-way clutch, put on the market by the Universal Gear Corp., 327 South LaSalle Street, Chicago, embodies a different principle in that it has surface contact. This construction, according to the manufacturer, insures long life and positive gripping and prevents the races from becoming pitted or scored.

With the final movement forward and with the slightest movement in reverse, the Pitter one-way clutch automatically locks, preventing the slightest reversing action. No parts can jam. Power applied in the forward direction instantly releases the pressure of the shoes against the inner and outer races of the clutch and the motion is smooth and instantaneous.

The number of times that the clutch can be stopped and started with the shoes locking and unlocking is practically unlimited. Clutches in operation on outside installations are reported to be performing at the rate of 60 and more such actions per second with accuracy.

The mechanism of the clutch is declared to be nonbreakable in action, provided the shaft sizes are identical. The outer and inner races of the clutch are said to be made from the finest material, carburized, hardened and ground, designed to withstand even greater locking pressure than the permissible inch pounds torque applicable on the shaft.

The Pitter clutch has large surface contacts to avoid rapid wear and scoring the races. There are no springs carrying loads, no teeth or light working mechanism to break, or fabric facings to be renewed. Wear, if any, is automatically taken up by the springs and does not affect the accurate operation of the clutch. The shoes move in a film of oil and all parts operate in oil. When there is movement of the shoes, there is no load, and when there is load, there is no movement.

Applications of the Pitter clutch include agitators, compressors, conveyors, excavators, hoists, intermittent drives, dual driven units, lifts, line shafting, lubricators, mixers, power shovels, reducers, screens, turbine drives and pumps.

ELECTRIC WELDING OF PIPE LINES ADVANCES

The last five months of 1930 showed the greatest advance in the electric welding of pipe line joints in the field since this method was adopted. The Welding Engineering Co. of Bartlesville, Okla., from July 24 to the end of the year completed the welding of 452 miles of large diameter gas pipe. The increased use of electric welding on large diameter lines is said to have been stimulated by the advent of the heavily coated rod and development of the shielded arc, making for greater strength and ductility. In the 452 miles there were over 40,000 welds. Most of this pipe was 20 to 24-inch in diameter. Not a weld has been reported cracked or broken.

The following lines were welded in the period mentioned: Cities Service Gas Co.'s line from Dilworth, Okla., to Wellington, Kans., 32 miles of 20-inch, solid welded; Missouri-Kansas Pipe Line Co. lateral lines in the Texas Panhandle, 24 miles of 18 and 20-inch, welded and coupled; United Gas Co. 90 miles between Refugio and Kennedy, and Converse and San Marcos, Tex., 12, 16 and 18-inch, welded and coupled; the Continental Construction Corp. (Chicago line), 306 miles in Texas, Oklahoma, Kansas and Iowa, 24-inch, welded and coupled. In addition to the above mileage completed in 1930, the company has uncompleted contracts of electric welding totaling 547 miles.

NEILAN ANNOUNCES LINE OF CONTROL APPLIANCES

The Neilan Co., Ltd., manufacturer of automatic control and regulating devices, is now marketing a line of tested instrument type recording controllers for temperature, pressure and flow. These Neilan instruments are built on a principle which gives the long-sought straight-line function. The maker claims new and improved methods of easy adjustment for all types of process control. Definite increments of movement of the control element produces uniform increments of movement of the diaphragm motor valve.

Neilan recording temperature or pressure controller.

This line of Neilan instruments is to be on display for the first time at the Oil Engineering and Equipment Exposition in Los Angeles. Descriptive literature may be obtained from Neilan Co., Ltd., 651 Santa Fe Avenue, Los Angeles, Calif.

NEW HEAVY-DUTY BRAKES

The General Electric Co. announces a line of band type, clapper magnet operated brakes for direct-current motors. These brakes, designated CR-9,517, were designed primarily for heavy-duty service such as cranes, steel mill auxiliaries, hoists and similar applications. Simplicity and long life are the outstanding advantages claimed by the manufacturer.

TURCO-PETMUSOL SOLVES TANK-CLEANING PROBLEM

Turco Products, Inc., Los Angeles, Calif., has developed a material to do cleaning jobs in the petroleum industry which is said to have a dual cleaning action, emulsifying the lighter ends of the oil and deflocculating the heavy ends. This action is of particular efficiency where a heavy, gummy deposit is encountered in the cleaning operation, whether in a heat exchanger, absorption tower or a storage tank.

An interesting use of Turco-Petmusol, as the product is called, is noted on a tank farm owned by a California oil company. Several 134,000-bbl. tanks had been storing residuum and the tanks were needed for white products. The cleaning of these tanks, to remove all traces of residuum, promised to be a difficult and expensive operation. The first five of these tanks have been cleaned with Turco-Petmusol at a cost below $1,000 each, which is said to be a record for this type of tank change-over.

The equipment used to handle the cleaning solution consists of a portable solution tank mounted on a trailer, two small double-acting pumps, an easily dismantled scaffold having three decks mounted on rubber wheels, piping and hose to carry the solution in and out of the tank.

The scaffold is placed inside the tank and assembled in a horizontal position on the floor. It then is raised to a vertical position, on its wheels, by means of a rope dropped through a manhole in the roof. The floor area immediately around the scaffold is dyked in with sand and sheet metal strips to act as a reservoir for the solution as it leaves the section of the wall being cleaned. The fluid carrying the removed residuum flows out of the tank into a settling reservoir, where the slight cooling results in the oil floating to the surface to be skimmed. The solution then is pumped back into the main solution tank to be heated to a temperature of 212° F., and used over again. A pressure of 100 to 125 pounds is maintained on the solution line.

The crews were able to work through regular eight-hour shifts in safety because, according to the manufacturers, no noxious, inflammable or hazardous fumes are given off by the solution.

MEN KNOWN *in* THE EQUIPMENT FIELD

I. W. Alcorn, formerly in various engineering capacities with the Independent Oil & Gas Co., has assumed his new duties as active head of the engineering and research development department of the Smith Separator Co., Tulsa.

I. W. Alcorn

Mr. Alcorn's boyhood was spent in the oil fields near Marietta, Ohio, and Robinson, Ill., where his father, I. O. Alcorn, was one of the early-day operators. He is a graduate of the Massachusetts Institute of Technology and the Missouri School of Mines and is a member of the American Institute of Mining and Metallurgical Engineers and of the American Petroleum Institute. His engineering experience has included pipe line construction, refining, natural gas division and chief engineer in charge of production while with Independent Oil & Gas.

AMONG THE EQUIPMENT HOUSES

The Shrader Electric Co., Los Angeles, Calif., has appointed the Tractor Truck Equipment Co., Tulsa, as its exclusive distributor for the territory east of the Rocky Mountains for all of its electrical equipment. This includes lighting plants and portable and semiportable welders, which can be mounted on any make of truck.

Goulds Punmps, Inc., Seneca Falls, N. Y., has appointed Fred H. Hayes manager of the pipe line pump department. Mr. Hayes will devote his entire time to pipe line sales and service activities, working through the present branch office organization.

The Lucey Products Corp. has added to its Shreveport district a new store in Kilgore, Tex. G. L. Blaxton is district manager, with headquarters in Shreveport. Lucian Hoard is local manager at Kilgore.

J. M. McNeal, European sales manager of the Landis Machine Co., Waynesboro, Pa., sailed for England after a three weeks' visit to the home office. Mr. McNeal has his headquarters in Birmingham, England, but supervises the sale of Landis threading equipment in both Great Britain and continental Europe. Associated with him is a Landis specialist, D. F. McLaughlin, also from Waynesboro.

At the annual meeting of the Trimont Manufacturing Co., Roxbury, Mass., Wallace L. Hancock was elected a member of the board of directors. Mr. Hancock has had over 20 years' association with the company as its treasurer.

STREAM LINE FILTER

The rights to manufacture and sell the Stream Line filter in North America have been acquired by the Oliver United Filters, Inc., New York. This novel type of filter has operating characteristics which offer filtration possibilities hitherto unavailable for certain industries. Problems in clarification of thin suspensions such as brine, water or oil, find their answer in the Stream Line filter, although it is not limited to this type of work alone.

NEW TYPE PUMPING JACK HAS ADJUSTABLE STROKE

Several advantages are claimed for two types of pumping jacks invented and patented by C. G. Cox and Henry M. Jarvis, of Eldorado, Kans. One of the jacks is of gear arrangement and the other is of the gear and sprocket-and-chain arrangement.

Both types have the advantages of adjustable stroke, straight-line lift at any stroke, length of stroke adjusted by changing second or intermediate gear or sprocket, the third or pull gear or sprocket adjustable to or from the second gear to put both in meshing relation.

Both jacks are of the underpull type and both can be counterbalanced to the pounds required, taking undue strain and weight from the pull rods and power. The jacks can be adjusted to any stroke desired for any individual well, regardless of the throw of the power eccentric. Both jacks are built within their own frame and can be used in connection with a small engine or motor with reduction gear for single well pumping and retain all the adjustable stroke advantages.

The gear and rack arrangement is designed to start the pumping action without the familiar jerk and to travel with more uniform speed the entire length of the stroke.

Technical Questions Answered

BY CHARLES K. FRANCIS, PH.D., TECHNICAL EDITOR

This department of The Oil and Gas Journal is devoted to the manufacturing branches of the oil industry.

Those connected with the refining of crude petroleum, the manufacture of natural gasoline and closely allied industries are invited to submit their problems to Dr. C. K. Francis, technical editor. The department was created for the purpose of aiding managers, superintendents, engineers, chemists and all those engaged in the various phases of plant operation; also those connected with the marketing and utilization of petroleum products.

Questions should be submitted in as much detail as possible so as to assure a satisfactory answer.

All inquiries should be signed and if other than the given initials are to be used please indicate the desired letters.

Questions involving patented processes, intricate formulas and calculations and estimates of costs, for obvious reasons, cannot be answered. The replies will appear on this page within a reasonable time.

GLUE IN KEROSENE

The United States specifications for kerosene requires that this product be free from water, glue and suspended matter. What type of foreign matter is referred to as "glue," and why was this particular term used in connection with a petroleum product?—F. F. M.

The ordinary meaning of the word glue is to indicate an organic substance of indefinite composition obtained upon evaporating a solution that has been prepared from animal matter, such as horn, skins, bones, etc. A more liberal definition might include any adhesive, sticky and gummy substance.

Glue is derived from the Latin verb "gluere," to draw together; and gelatine from "gelare," to congeal, which is related to our words chill, gelid and jelly. The word glue is commonly used as meaning the adhesive, while gelatine refers to substances having stiffening or jellying properties.

For many years before the drilling of the Drake well, making available large quantities of petroleum, chemists had been endeavoring to invent a cheap, safe and efficient illuminant to replace tallow candles, whale-oil lamps and the other means of artificial illumination then in use. Whale oil was extensively used, also other oils of animal origin, and in the extraction of these oils glue and gelatinous materials were often included accidental impurities. One of the earliest "improved illuminants" consisted of a mixture of coal oil and whale oil. Other mixtures followed and consequently glue was frequently found in illuminating oil.

The present government specification, Technical Paper 323B, Bureau of Mines, carries as the second specification under kerosene, long-time burning oil, and 300-degree mineral seal: "The oil must be free from water, glue and suspended matter." This may be based on the early history of kerosene, etc., if it means real glue. If it means glue in a more liberal sense, practically all kerosene on the market could be rejected if the specification were to be enforced.

Dr. H. C. Dickinson, chairman, Lubricants and Liquid Fuels Committee, Federal Specifications Board, gives this explanation:

"In reply to your letter regarding the reference to glue in the Government Kerosene Specifications, an inquiry throughout the bureau in regard to this matter has not developed any very definite information. Apparently this requirement is intended to apply to glue in the normal sense of the term and not to any glue-like material which may be present in the kerosene. It is believed that this requirement is based on the former practice of sizing with glue wooden barrels for the shipment of petroleum products and other liquids such as alcohol which would penetrate the lumber. Obviously, the use of inferior qualities of glue or the improper drying of the glue sizing before use might have resulted in the occurrence of glue in the kerosene."

PULVERIZED COAL FOR STEAMSHIPS

Is there any serious objection to the proposal to use pulverized coal in place of fuel oil on steamships? The suggestion has been made that the coal could be pulverized on shore and run into the ship's storage about the same way as oil. —E. M. A.

We do not know of any boats which use pulverized coal from storage that has been prepared on shore. The units for pulverizing coal may be set up on board close to the boilers in a similar way to that followed in boiler plants. While pulverized coal may be transported a short distance through pipes, it appears that the storage of such material on board of a steamer would not be advisable.

Pulverized coal is a dangerous material to attempt to store in large quantities because of its tendency to ignite through spontaneous combustion; also, coal dust resembles the combustible gases in that it will ignite upon the introduction of a spark or flame, and when mixed with air will form a very powerful explosive mixture.

It would seem that these well-known properties of pulverized coal must constitute a formidable objection to its handling in an extensive way as would be necessary if it were stored in steamships. Fuel oil is the ideal fuel for vessels and under present market conditions is quite widely available at a low cost.

CARBON DIOXIDE FROM NATURAL GAS

We have a gas well showing 20 per cent carbon dioxide and making 700,000 feet a day under 400 pounds pressure. Would this pay for making solid carbon dioxide? Have you any information covering cost of carbon dioxide plants?—E.T.

Natural gas has been found in several places which contains large quantities of carbon dioxide. In some instances the gas is practically pure carbon dioxide, but most of these are so far removed from the consuming centers that it has not appeared commercially feasible to attempt the manufacture of solid carbon dioxide. The usual oily odor must be removed and the product compressed into cakes or blocks for distribution. A relatively small quantity of carbon dioxide, if all other conditions were favorable, would probably not justify its extraction for commercial use.

At this time exceedingly large supplies of carbon dioxide gas are obtainable, and cheap transportation to the industrial and densely populated centers is available, from the wells near Tampico, Mexico. An account of the development of a market for solid carbon dioxide from this source has been issued by Dr. J. W. Martin in a report to the American Chemical Society. This statement illustrates what difficulties must be considered. A part of the report follows:

About 15 years ago an oil company, drilling south of Tampico, Mexico, in the Quebrache Field, was surprised to bring in a well of noninflammable gas under high pressure but containing practically no oil. Subsequent wells brought in commercial oil wells from each of which large quantities of carbon dioxide had to be continuously blown off in order to obtain satisfactory oil production. With a rapidly developing market for solid carbon dioxide the value of this gas that has been blowing away became apparent, particularly since the total open flow of the present wells was found to be capable of producing more than 900 tons of solid carbon dioxide daily.

The production at Quebrache is now more than 14 years old. One of the wells "blew wild" from 1916 to 1927, discharging probably 1,000 tons of carbon dioxide per day, yet there was no apparent dimunition in flow on this well or drop in pressure on adjacent properties.

The unique combination of high pressure and high quality, coupled with proximity to water transportation, which this source of carbon dioxide offered, led to the development of a process for its manufacture and the erection of a trial plant to perfect a commercial method of purifying the gas sufficiently to obtain high snow yields and to render the gas free from odors.

After the gas is purified, it is cooled, liquefied, and passed through jets into snow chambers, and from these chambers the snow is removed and put into molds, and there compressed into ice. The problem was to form a block of ice that would be of commercial density and texture when it arrived in New York, and which would be sold sometimes as much as six weeks subsequent to its manufacture. The best results were obtained through compressing the dry snow to a fairly high density.

From Tampico, water transportation can be had to any Gulf or Atlantic port at freight charges less than that from Cleveland to New York City. Markets up the Mississippi River are also available. This will mean a great flexibility in marketing the product, and help materially in building up a uniform all-year business. For in the winter, when business in this line is quiet in New York, it is very active in the South.

The cost of producing solid carbon dioxide from this source is very low, Doctor Martin points out. "In the States," he says, "independent solid carbon dioxide plants have cost $10,000 to $25,000 per daily ton of production. With these high-pressure wells as a source, the plant cost is about $3,000 per daily ton."

PINK COLORED GASOLINE

Is it known what form of sulphur is the cause of coloring gasoline pink to red? Some of our crude yields this colored gasoline, especially the cracked, but others do not. This is acid treated and sweetened. Any information will be appreciated.—J. C. N.

It appears that the higher mercaptans may be responsible for the formation of the pink or red color which is frequently developed in gasoline that has been made from certain high-sulphur crude oils. The recently reported work of Elgin, Ind. Eng. Chem., Vol. 22, 1,292, 1930, may be of interest.

"Several mercaptans in naphtha solution were tested for sulphur absorption by a nickel catalyst. The quantity of the catalyst was large, 25 gs. to 100 cc. of naphtha, so it may be that enough of the catalyst actually entered into combination to have a part in the formation of the colored compound.

"On shaking the naphtha solutions of butyl and isobutyl mercaptans with the reduced nickel catalyst a deep red color developed after about a 10-minute interval. This color completely disappeared after 10 days' standing, leaving the solution colorless. Reed and co-workers have obtained this red color in the case of secondary mercaptans in experiments directed toward the determination of the adsorption of mercaptans on cupric sulphide. They do not state whether or not the normal and isomercaptans exhibit the phenomena. It appears, however, that it is specific neither for secondary mercaptans nor for cupric sulphide."

The general rule is for the pronounced red color to appear in the higher fractions, such as those represented by the lubricating oils, and the normal color for the gasoline fraction is from colorless to a very faint yellow. It is also known that the quantity of sulphur increases from the lighter to the heavier fractions. These facts appear to indicate that the higher mercaptans, sulphides, or possibly thiophene may have something to do with the several color phenomena, especially browns, reds and greens, so frequently observed in chemically treated fractions of the gasoline range.

INHIBITORS AS COLOR AND GUM STABILIZERS

Are the inhibitors used for stabilizing the color of gasoline also of value for preventing formation of gum? Can you furnish a list of suitable inhibitors with the quantity to be used?—M. C. H.

There are numerous substances that have some merit as effective stabilizing agents for controlling color and gum formation in gasoline. It appears that the selection of an inhibitor of this character depends on the chemical composition of the gasoline, which naturally is related to the source of the crude oil and the refining process. An inhibitor that is found satisfactory with one gasoline will not give good results with another gasoline from another source or with one that has not been through identical treatment. There are a few inhibitors that influence both color and gum formation but in many instances the chemical is limited to the one field.

Egloff, Faragher and Morrell have investigated several inhibitors, How Some Inhibitors Affect Knock Rating Gum and Color in Cracked Gasoline, Universal Oil Products Co., Booklet 79. Some of their results are shown in the table.

Color After Exposure to Sunlight

	Gasoline 1	Gasoline 2	Gasoline 3
Stabilizer—	24 hrs.	8 hrs.	3 days
Camphor	22	..	19
Phenanthrene	21	..	18
Urea*	21	..	21
Pseudo-cumene	21	16	..
Acenaphthene	21	16	..
Alpha methylnaphthalene	20	16	..
Anthracene	20	..	19
Naphthalene*	20	..	19
Fluorene	20	16	..
Tetralin	19	..	21
Beta naphthol	19	16	..
Hydroquinone	19	..	..
Phthalic anhydride*	19	..	18
Phthalimide	17	..	19
Carbazole 60%*	15	..	14
Pyrene*	10	16	..

Those marked (*) were used in gum experiments also, all materially retarding gum increase; the best results being shown by naphthalene and pyrene.

The quantity of the inhibitor used in all experiments was equivalent to 0.1 per cent of the gasoline. We have evidence that these quantities are excessive, in fact one-thousandth to a ten-thousandth per cent of the better inhibitors would be effective for ordinary conditions where the product may be exposed for a comparatively short time. An exposure of three hours would certainly be more than enough to meet a reasonable condition concerning exposure to light at the filling station.

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Yields From Oklahoma City Crude Oil

More Than 75 Per Cent Gasoline Obtainable in Well Balanced Skimming and Cracking Operation. Diesel Fuel Also Secured

By Gustav Egloff, E. F. Nelson and Paul Truesdell
Universal Oil Products Co.

The total gasoline yield from the Okla-City, Okla., crude oil is 75.8 per cent. The yield of straightrun gasoline in the crude is 34.4 per cent and the cracked product 41.4 per cent of the crude oil.

The following table gives the yield of gasoline and other products per barrel of Oklahoma City crude oil refined:

Gasoline	75.8%
Furnace or Diesel oil	7.1%
Gas (cu. ft. per barrel)	524
Coke (lbs. per barrel)	28.9

Examination of the crude oil from the Oklahoma City Pool showed the following distillation characteristics:

CRUDE OIL

(A.S.T.M. 100 cc. distillation)

A.P.I. gravity	38°
Init. B.P.-end B.P.	146°-706°F.
Sulphur	0.13%

Per cent distilled over	Temp. °F.
5	205
10	248
20	327
30	410
40	498
50	572
60	656
70	688
80	694
90	696
95	700
Endpoint	706

Per cent over	98
Per cent at 410° F.	30
Per cent at 437° F.	33
Per cent at 572° F.	50
Per cent bottoms and coke	2

The crude oil was also distilled through a Hempel column by fire distillation at atmospheric pressure until the gasoline and kerosene were separated. The beads in the Hempel column were then removed and distillation continued at a pressure of 40 mm. to recover the gas oil and lubricating oil fraction. The results of this distillation are as follows:

FOURTH OF SERIES

The accompanying article is the fourth of a series describing results obtained in skimming and cracking operations with representative crude oils.

The following crude oils were described in previous issues:

February 19—Refugio, Tex.

February 12 — Pennsylvania grade crude.

The fifth of the series will be concerned with West Texas crude oils. Each article contains a complete discussion of a particular type of crude oil.

ANALYSIS OF OKLAHOMA CITY CRUDE OIL

(1,600 cc. Hempel distillation)

A.P.I. gravity	38
Initial boiling point °F.	87

DISTILLED AT ATMOSPHERIC PRESSURE

Per cent distilled over	Temp. °F.	A.P.I. gravity
10	223	74.2
20	309	56.9
30	395	...
34.4	440	42.0
37.3	465	...

DISTILLED AT REDUCED PRESSURE

Per cent distilled over	Temp. °F.	A.P.I. gravity
40	315	...
45	341	38.1
50	380	36.8
55	415	35.1
60	455	33.1
65	500	31.3
70	530	30.0
75	550	...
80	590	...
85	620	...

Chemical Treatment

The gasoline derived from the atmospheric distillation of the crude oil was treated with 3 per cent by volume of 30° Be. sodium plumbite solution and just enough elementary sulphur to break down the mercaptides. The product was then washed well with water and after settling the sludge was drawn off. The resultant gasoline had a 30 Saybolt color, was light-stable, doctor-sweet and noncorrosive, and contained no gum and only a trace of sulphur. Distillation characteristics of the unrefined and refined straightrun gasolines are tabulated below:

STRAIGHTRUN GASOLINE

(A.S.T.M. 100 cc. distillation)

Gasoline—	Unrefined	Refined
A.P.I. gravity	56.8	56.6
Init. B.P.-endpoint °F.	122°-437°	134°-435°

Per cent distilled over	Temp. °F.	Temp °F.
5	169	174
10	188	194
20	218	218
30	243	238
40	265	262
50	291	282
60	317	302
70	340	329
80	366	355
90	401	385
95	430	409
Endpoint	437	435
Total per cent over	96	98
Residue, per cent	2	1
Loss, per cent	2	1

Summarizing the yields of products by atmospheric and vacuum distillation of Oklahoma City crude, we have:

400°F. endpoint straightrun gasoline	29.4%
A.P.I. gravity	59.3°
I.B.P., endpoint °F.	120°-402°
437°F. endpoint straightrun gasoline	34.4%
A.P.I. gravity	56.8°
I.B.P., endpoint °F.	122°-437°
Sulphur, per cent	0.03
Kerosene	2.9%
A.P.I. gravity	42.0°
Sulphur, per cent	0.03
Gas oil	30.7%
A.P.I. gravity	34.4°
I.B.P., endpoint °F.	487°-749°
Per cent at 572° F.	36.5
Cold test	+36°F.
Furol visc. at 77°F.	12 sec.
Sulphur, per cent	0.15
Lub oil (medium)	15.0%
Saybolt Universal visc. at 100°F.	283 sec.
Cold test	+79°F.
Flashpoint (Cleveland open cup)	270°F.
Firepoint	405°F.
Sulphur, per cent	0.26
Wax (Reistle & Blade method)	5.4%
Still residue	14.5%
A.P.I. gravity	19.3°
Per cent b.s.&w. (benzol-centrifuge)	0.7
Per cent at 572°F.	2.0
Per cent coke by weight.	12.1
Cold test	+40°F.
Furol visc. at 122°F.	334 sec.
Sulphur, per cent	0.39

Topped Crude

The topped crude oil remaining after removal of the 437° F. endpoint gasoline fraction was used as cracking stock. It contained 0.25 per cent sulphur, and the amount of hydrogen sulphide formed during cracking was about 0.1 pound per barrel of topped crude oil. The charging stock analyzed as follows:

TOPPED CRUDE OIL

(A.S.T.M. 100 cc. distillation)

A.P.I. gravity	28.9°
Init. B. P.-endpoint °F.	484°-726°
Flashpoint, Cleveland open cup	260°F.
Firepoint, Cleveland open cup	300°F.
Furol visc. at 77°F.	35 sec.
Cold test	+25°F.
Per cent b.s.&w. (benzol-centrifuge)	Trace

Per cent distilled over	Temp. °F.
5	512
10	539
20	566
30	615
40	657
50	684
60	696
70	704
80	713
90	724
95	726
Endpoint	726
Per cent over	98.0
Per cent over at 572°F.	31.0
Per cent coke by weight	2.2

Operating Conditions

This topped crude was converted into gasoline, furnace oil, gas and coke by the cracking process using the simultaneous cracking and coking operation. The conditions of conversion were 850° F. and 150 pounds pressure. The topped crude oil was charged to the still and pressure distilled, so as to produce cracked distillate, gas and coke.

Cracking Results

The data on cracking the Oklahoma City topped crude is summarized as follows:

Oklahoma City topped crude, per cent	100
A.P.I. gravity 28.9	
Pressure distillate, per cent	75.5
A.P.I. gravity 50.9	
Coke (lbs. per bbl.)	44.0
Gas (cu. ft. per bbl.)	799.0
Coke, gas and loss, per cent	24.5

	Per cent of topped crude
Gasoline	57.5
A.P.I. gravity 58.5	
Initial boiling point 120°F.	
End boiling point 402°F.	
Pressure distillate bottoms (Furnace or Diesel oil)	17.0
A.P.I. gravity 28	
Gasoline	63.6
A.P.I. gravity 56.1	
Initial boiling point 126°F.	
End boiling point 437°F.	
Pressure distillate bottoms (Furnace or Diesel oil)	10.9
A.P.I. gravity 24.4	

Pressure Distillate

The unrefined pressure distillate oil from cracking the topped crude was distilled through a Hempel column with the following results:

ANALYSIS OF UNREFINED PRESSURE DISTILLATE

(800 cc. Hempel distillation)

A.P.I. gravity	50.9°
Initial boiling point °F.	84°

Per cent distilled over	Temp. °F.
10	161
20	203
30	245
40	276
50	311
60	350
70	389
76.1	410
84.3	450

The 410° F. fraction produced 76.1 per cent of 400° F. endpoint gasoline of gravity 58.5° A.P.I. Pressure distillate bottoms in this case were 22.5 per cent, and loss 1.4 per cent. The 450° F. fraction by the above distillation yielded 84.3 per cent of 437° F. endpoint gasoline of gravity 56.1° A.P.I., 14.3 per cent of pressure distillate bottoms of gravity 24.4° A.P.I., and 1.4 per cent loss.

Chemical Treatment

The pressure distillate was refined by the simple acid, caustic soda and water wash process, i.e., it was agitated with 3 pounds of 66° Be. sulphuric acid per barrel. The acid sludge was drawn off after settling and the product washed well with water; then 1 per cent by volume of 16° Be. caustic soda solution was used for neutralization and, after settling and drawing off the sludge, the product was redistilled at a still temperature of 350° F. This treatment produced a 437° F. endpoint gasoline of 29 Saybolt color which was light-stable, doctor-sweet and noncorrosive. The gum content was 8 mgs. per 100 cc. and the sulphur 0.03 per cent.

Cracked Gasoline Analysis

The refined and unrefined cracked gasolines distilled as follows:

UNREFINED AND REFINED CRACKED GASOLINE

(A.S.T.M. 100 cc. distillation)

Gasoline—	Unrefined	Refined
A.P.I. gravity	56.1	56.0
Init. B.P.-endpoint °F.	126°-437°	121°-437°

Per cent distilled over	Temp. °F.	Temp. °F.
5	155	164
10	174	184
20	206	213
30	232	238
40	256	261
50	280	283
60	303	303
70	327	326
80	362	356
90	400	396
95	426	422
Endpoint	437	437
Total per cent over	97.0	98.0
Bottoms, per cent	1.5	1.0
Loss, per cent	1.5	1.0

Pressure Distillate Bottoms

The pressure distillate bottoms are useful for furnace or Diesel oil, or gas-making, or may be converted into motor fuel by cracking. The pressure distillate bottoms are the fraction left after the 437° F. endpoint gasoline is recovered, and the distillation range is shown in the table:

UNREFINED PRESSURE DISTILLATE BOTTOMS

(A.S.T.M. 100 cc. distillation)

A.P.I. gravity	24.4°
Initial boiling point-endpoint °F.	456°-718°

Per cent distilled over	Temp. °F.
5	474
10	478
20	486
30	493
40	501
50	513
60	527
70	545
80	572
90	626
95	686
Endpoint	718
Per cent distilled over	99
Per cent bottoms	1

Gas From Cracking Process

The gas produced from cracking the topped crude oil has high thermal value. It averages 1,500 B.t.u.'s per cubic foot. The gas has excellent value as a blending agent for low heat value gases, such as those derived from coal as producer or water gas. The cubic feet of gas per barrel of oil processed were 799.

Coke

The coke produced by the cracking process is of a honeycomb structure interspersed with high melting point pitchy hydrocarbons. The thermal value is approximately 15,500 B.t.u.'s per pound, the volatile content 15 per cent, and fixed carbon 83 per cent. The ash content represents 0.5 per cent of the coke, while the sulphur showed 0.7 per cent.

The coke may be burned as such or in powdered form so as to yield high efficiency of combustion. When the coke is burned in powdered form with small excess of air, the carbon dioxide content of the products of combustion is approximately 16 per cent. This content of carbon dioxide in the combustion gases gives an excellent source for solid carbon dioxide or "dry ice" manufacture.

The coke may be used in producer gas or water gas manufacture. These low grade fuel gases may be blended with the cracked gas to a product having a B.t.u. content of 535 per cubic foot which is a standard city gas value.

Chemical analyses, by the Egloff and Morrell method,[1] of the straightrun and cracked gasolines gave the following compositions:

Per cent—	Straight-run gasoline	Cracked gasoline
Unsaturated hydrocarbons	3.6	16.3
Aromatic hydrocarbons	6.6	25.2
Naphthenic hydrocarbons	9.1	6.7
Paraffinic hydrocarbons	78.7	51.2

The straightrun and cracked gasolines were blended in the proportion in which they were made from the crude, i.e., 45.4

(Continued on Page 168)

[1] J. I. E. C. 18, 354 (1926).

Take Highways to Prosperity

By W. T. ANDERSON

This Annual Refinery Number of The Oil and Gas Journal is devoted primarily to articles describing the tremendous progress of that branch of the oil industry along technical lines. These articles demonstrate how effectively the refining industry has kept pace with the demand for all types of its products with continual improvement in quality and efficiency in manufacturing processes.

But while there can be no doubt that the refining industry will continue to do its part in the production of desired products, does it not behoove those in charge of that division of the industry to give more of their thought to the stimulation of demand for their products?

It is useless to produce a supply of products if there is not a ready market for them.

As one phase of this effort it might be well to revive the slogan "See America First."

This slogan aided materially in promoting travel within the boundaries of the United States when first launched.

By sponsoring a "See America First" campaign the oil industry could become a leader in the return to normal prosperity. Many who in the past few years have taken trips abroad are in the mood for the more economical and just as enjoyable tour of the beauty spots of their own country if they were informed of the ease with which they can be reached.

The hundreds of millions of dollars spent annually by Americans in Europe if spent seeing our own country would be a big factor in restoring normal times at home.

The railroads were the principal beneficiaries of the original campaign for the reason that the automotive industry at that time had not yet produced sufficient cars to promote general advantage from it and because the country was then unprovided with improved highways.

In 1915 there were only 2,250,000 cars in the country and only a few thousand miles of improved roads.

Today there are over 26,000,000 cars and nearly 600,000 miles of improved highways and 900,000 miles of roads which are satisfactory to drive over.

In the seven years ending in 1923, $407,000,000 was spent in building roads in this country. Last year alone the highway improvement investment ran over a billion dollars.

That shows how road conscious the nation has become in a very few years. And the popular attitude has changed just as rapidly, thanks to the motor vehicle and the gasoline which propels it.

When the first good road movement was begun, largely under the inspiration of bicycle manufacturers, the farming districts were but slowly won over to the idea because of fear of higher taxes. Then as good roads were discovered to be aids to the farmers they were extended primarily with the purpose of furnishing wagon transportation to and from markets.

With the advent of the automobile a little more progress was made but it was not until there were approximately 5,000,000 cars in the country that the improved highway advocate was accorded a popular hearing.

The gasoline tax was originated through this growing popular conception of good roads as worth paying for even by the urban population.

This year the motor owners will pay nearly $600,000,000 in gasoline taxes in addition to $325,000,000 in motor licenses, or over a billion dollars in these and other fees directly levied upon the car user.

These improved roads—the tracks of the automobile—are being widened and constructed with a view to increased speed and safety. Not so long ago the vacationist using his car was restricted by highway conditions and car imperfections so that about half his holiday period was allotted to taking him to his outing spot and bringing him back. Today the range of the holiday motorist has been immensely enlarged by better roads and dependable cars capable of higher speed and more economical operation.

When the original "See America First" movement was begun the railroads, hotels and restaurants at vacation resorts reaped a harvest but the vacationists themselves were usually tied to the spot they had chosen unless they resorted to the horse and buggy.

Nowadays the motoring vacationist can transport himself and his family in his own car, say 1,500 miles, for an expenditure of between $18 and $20 for gasoline and motor oil and have his car with him when he reaches his chosen resort for trips to interesting or beautiful places all around.

In the earlier days of open type cars there were many disadvantages and discomforts about a long motor trip which have been removed by the closed car and the universal presence of service stations all along the highways, so that motoring long distances now really justifies the term "pleasure car."

Yet the records of tourist travel are far from what they might be if the proper emphasis was put upon the joys of modern sightseeing in our own country.

"See America First" would avoid the discomforts and annoyances of foreign travel, and on the contrary offer all the comforts and conveniences to which we have become accustomed at home.

In the way of natural attractions no country anywhere can present the magnificent beauty of our national parks which only a fraction of our people have seen or thought of visiting. These great pleasure grounds offer every variety of scenery, from glaciers to geysers, from mountain tops to caverns, rolling hills and vast canyons, with glorious coloring not to be found anywhere else on earth.

All these parks are easily accessible by motor car and within vacation reach of most of our people possessing cars. They have been set aside and improved at public expense, just as have our improved highways and every car owner who fails to take advantage of the opportunity to enjoy them is depriving himself of what he has paid for.

The proposed expenditures for state highways, including state, federal, city and county appropriations, for the present year aggregate more than $2,500,000,000. Gasoline taxes alone cost the motor owners $1,500,000 a day.

All that is needed is an appeal to the imagination of automobile owners to insure a maximum use of their cars and a maximum return upon the money they have invested in purchase and operation of their cars, license and taxes they have paid.

Motor owners who limit their travel to daily routine are paying an enormous sum for privileges that they never try to get any personal return from, the great system of improved highways, the splendid national parks, the "magic-carpet" like ease in transportation over great distances which is theirs at will—all made possible by their personal contributions to the tax revenue of city, state and nation.

Having paid for these things why not use them and get some benefit from them? Yet last year only 2,500,000 persons out of our 130,000,000 population visited our national park system.

It paid the railroads to start the "See America First" campaign when but a fraction of the people could afford to take the trip. How immensely more would it pay the oil industry, the automobile industry and the industries which find their main market in the motoring public's purchases, to get behind a united drive to make the nation actively conscious of the pleasure and benefit in "Seeing America First."

Utilizing Exhaust Stream in Refineries

Tangible Savings to Be Realized Through Its Use Largely in Fuel and Water. Reduces Investments.

By A. L. Strout
Standard Oil Co. of California

Low-pressure steam can be made available from the exhausts of engines of all kinds, turbines, flywheel engines and straight-line pumps. It is, as a rule, desirable to maintain the exhaust pressure at 5 pounds gauge or higher to establish practical operating conditions. The pressure decided upon will depend on the back pressures at which the power units carry their load and the pressure required to take care of line loss and provide steam for the heating and distillation processes.

In as much as the steam demand of the engines increases and the maximum

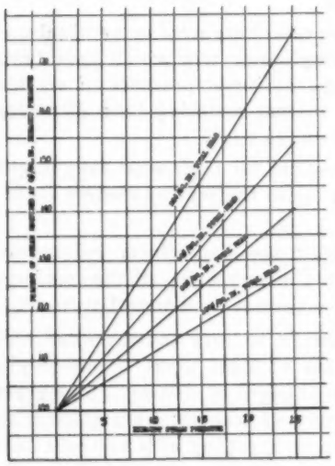

Figure 1—Group of straight line curves plotted to show the increase in steam demand as influenced by the exhaust pressure for a direct acting pump. Ratio steam to liquid ares— 1.5:1; steam at 100 pounds gauge—dry saturated; moderate pumping speeds. Allowance is made for valve losses and pump friction.

power decreases with the increase in exhaust pressure, a careful study must be made to determine the pressure at which the exhaust system should be operated for best economy. The higher the pressure the smaller can be the pipe lines for a given demand. If, however, the process demands are much below the supply for considerable periods, the higher back pressures on the power units will cause a wastage of steam. It can be stated that in general, high back pressures should be chosen when the process steam requirements are usually in excess of the supply from exhaust sources.

Effect of Back Pressures

The effect of a rise in the exhaust pressure of power units is to increase the steam demand. The increase in demand is practically a straight-line function of the exhaust pressure for any fixed power requirement. Although the power-steam relation of each unit must be given consideration when designing an exhaust steam system, the accompanying graphs may be of interest in passing. Figure 1 represents a group of straight-line curves plotted to show the increase in steam demand as influenced by the exhaust pressure for a direct-acting pump. The curves are steeper for the lower load factors, flattening out as the load factor increases. Figure 2 presents two curves showing the relation of steam demand to back pressure for a steam turbine operated at 760 r.p.m. and 800 r.p.m., respectively. Information such as is presented in these figures can be made use of in determining a balance between power and process steam supply.

Piping System and Regulators

The burden of transmitting low-pressure steam must be carefully considered in laying out a dual system. In large plants, where distances are great, it is often desirable and practical to develop the system in areas, each area being balanced for power and process steam requirements. This scheme saves the expense of long pipe lines. Where the areas will not balance in themselves relatively small equalizing lines may be warranted.

It is possible to adjust operations within a refinery so that the balance between power and process steam demands is materially improved. Transfer pumpings can frequently be done during the peak of process steam requirement, and processing can, to a certain extent, be adjusted to the unavoidable peaks of power demand.

Commercial regulators are available for admitting live steam make-up for the maintenance of constant pressure on the exhaust system and for relieving the excess low-pressure steam to the air or to lower pressure lines for return to the hot wells. Figure 3 shows a piping layout for a dual system as worked out for a relatively small oil refinery. Figure 4 shows the regulating scheme in more detail.

Application to Distillation

The use of low-pressure steam is, as a rule, as satisfactory in distillation processes as is high-pressure steam, the factor of agitation in the stills sometimes, however, requires special attention. This factor as well as the proper distribution of the steam through the coil orifices can be readily taken care of in the coil design.

The function of steam in distillation, aside from agitation, is to reduce the temperatures required for vaporization through its partial pressure effect and

(Continued on Page 202)

IMPORTANT ECONOMIES MADE POSSIBLE

Steam has three important uses in oil refineries: Power (principally for pumping,) heat and distillation. Power units require high pressure steam and utilize only a small percentage of the heat content which is lost through the exhaust. Prevention of this waste of energy by utilization of exhaust steam for certain processes at the refinery is discussed in this article.

This source of energy, obviously, will be restricted to processes requiring relatively low pressures and temperatures, and these include a considerable number, among which may be noted open and closed system heating and distillation. Economic advantages which may be realized are contingent upon local conditions. Where an abundance of exhaust steam is available large savings may be made in fuel, water, boiler house operation and maintenance costs. In instances where expansion in process steam requirements is indicated, the utilization of exhaust steam may make the investment in additional boiler capacity unnecessary, and in these cases the savings realized by the low pressure steam systems include capital as well as operating and commodity costs.

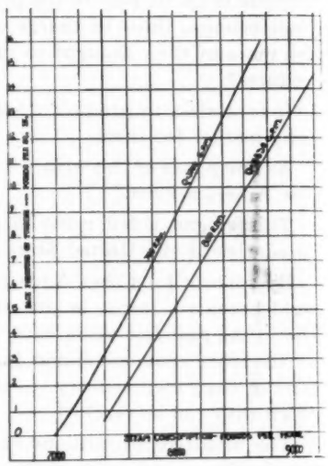

Figure 2—Relation of steam demand to back pressure for a steam turbine operated at 760 r.p.m. and 800 r.p.m., respectively, is shown in these two curves. Turbine run at constant speeds and loads. Steam pressure—92 to 96 pounds. Turbine rating: 100 horsepower at 800 r.p.m. Steam pressure: 85 pounds; back pressure, 5 pounds.

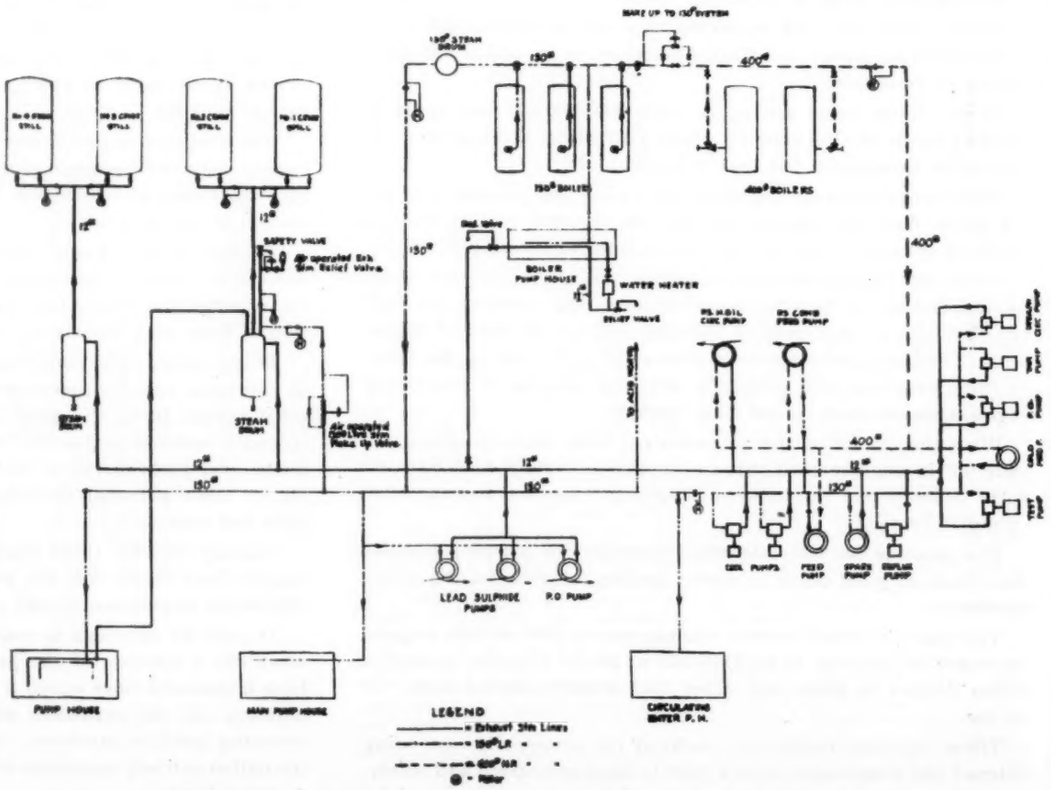

Figure 3—A piping layout for a dual system in a comparatively small refinery is shown here.

Run deFlorez Cracking Units to Coke

Secure Long Operating Cycle and Produce Gasoline of High Octane Number at Port Arthur Plant of The Texas Company

By P. F. Swanson
The M. W. Kellogg Co.

For a number of years past the desirability of operating a cracking unit to solid residuum or coke has been the subject of much controversy.

The primary object of any refinery operation is obviously to enhance the market value of the processed oil, which involves consideration of the price of the original stock, cost of processing and relative marketable value of the products formed. To generalize on the commercial possibilities of a cracking-coking operation is, obviously, impractical since the financial returns of such an operation must necessarily be based on the character of the charging stock, the locality of the unit and the markets available, all of which are variable.

Aside from the economic aspects of processing to coke, many technical details of operation have, in the past, contributed to the uncertainty of a suitable financial return. To be more specific, it has become evident that the quality of the coke must be controlled, the processing made continuous and operating costs reduced.

Recycle in Vapor Stream

Based on extensive experimental work, it has been apparent that the operating problem can be materially simplified by obtaining the coking effect in a stream of high temperature vapors. This, together with the circulation cycle, essential to long periods of continuous operation, and with provisions made for regulating the coking effect by independently controlling certain parts of the process, has at least brought the cracking-coking to a mechanical success. The economic aspect of running an oil to coke in a cracking system, however, must remain a matter for individual determination and the choice of this operation must be based on a careful study of charging stock and available markets.

The development of the high temperature cracking-coking operation is well exemplified by the operation of the deFlorez unit erected at The Texas Company's plant, Port Arthur, Tex., which has now been in operation about a year, running on various grades of charging stock to produce gasoline and coke continuously, and from which a great deal of variable technical information has been acquired.

The unit, which is rated at 1,000 bbls. of gasoline per day, comprises a heater with about 4,200 square feet of surface, two coke drums 10'x40', two fractionating towers 10'x40' and 10'x50', respectively. The unit is also equipped with a self-contained absorption system for stripping the condensables from the gas. Figure 1 shows a diagram of the plant, while Figures 2 and 3 are views taken on the heater side and on the coke drum side, respectively. The actual distillate capacity has averaged from 1,200 to 1,300 bbls. daily since placed in operation.

Description of Flow Chart

Referring to the diagram, the charging stock is admitted to Tower No. 1 where it meets the vapors discharged from the heater. Here cracking distillation takes place. The vaporized products then pass on to Tower No. 2, the bottom of which forms an accumulator tank for the cycle stock. The separation and fractionation of the cracked distillate vapors from the cycle stock is accomplished in this column. The overhead vapors are cooled in a condenser and the gasoline recovered under about 60 pounds pressure. The gases from the separator pass to the absorption tower where the heavier components in the gases are absorbed by the cooled gas oil cycle stock introduced at the head of this column. From this tower the dry gases pass overhead while the rich oil, withdrawn from the base, is returned to Towers Nos. 1 and 2 as reflux. Suction is taken from the separator by a reflux pump which discharges cold naphtha over the top bubble tray of No. 1 tower for control purposes. The liquid product from the separator then passes to a weathering drum, where the pressure is reduced to several inches vacuum, and thence to storage. The vapors from the weathering drum are compressed and reintroduced to the absorption system for further stripping.

Suction is taken at the base of No. 2 tower by the main circulating pump, which discharges the cycle stock first into a small economizer section in the top of the heater. From this section the oil passes in series through the vertical tubes and through the transfer line to the coke drums. At a point intermediate between the heater and the coke drums, residuum withdrawn from No. 1 tower is mixed with the hot vapors from the heater and the combined flow is discharged to the coke drums. The products entering the coke drum are virtually all vaporized and pass overhead into No. 1 tower, completing the cycle.

Long Operating Cycle

In this method of operation, it will be noted that only clean stock which has been completely distilled and selected after passing through several bubble trays in No. 1 tower is admitted to the accumulator section of No. 2 tower and thence to the circulating pump and heater. Extremely long runs are made possible in this manner, since practically no carbonization takes place in the tubes due to careful control of the quality of the cycle stock.

It will be further noted that the heavy residuum formed in the cracking operation and which is to be coked is actually withdrawn from the system at the base of No. 1 tower and returned to the system into the coke drums by means of a pump; furthermore, that this material is subject to careful measurement and adjustments in temperature, both of which are relied upon for control of the quality of the coke subsequently made. This step in the process differs from former methods, where residuum is merely allowed to accumulate in the coking space. The effect of this step in the deFlorez unit is to insure continuous and regular vaporization and coking of the residuum returned to the system from No. 1 tower, which eliminates the possibility of unevenness in the coke layer or pitch pockets. The hardness and volatility of the coke is varied from the observation of the resulting temperature in the coke drums.

The drums which are vertically disposed are provided with a drill pit and bit located beneath their base and actuated by a steam engine for cleaning. The drums are used alternately, one

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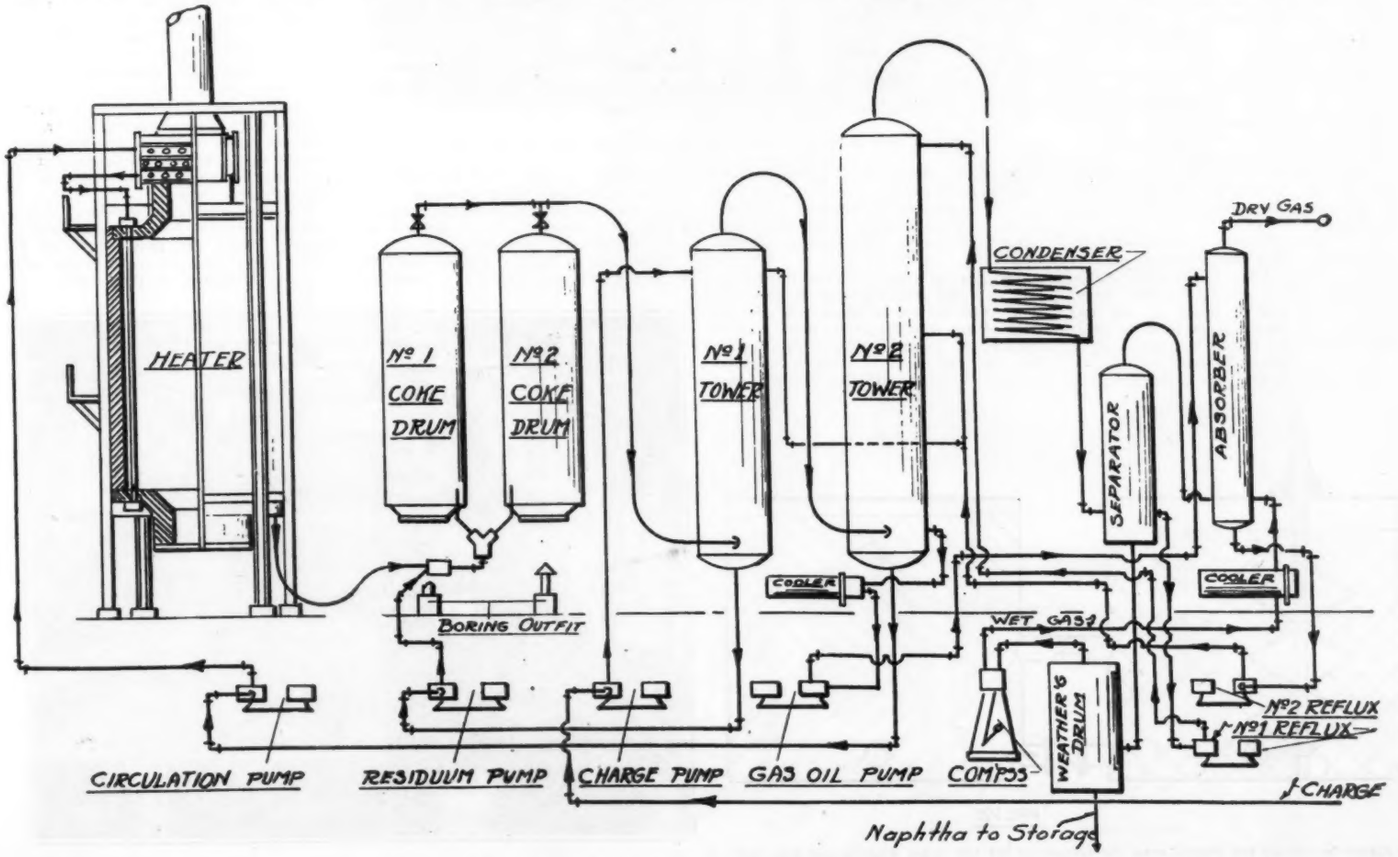

Flow chart showing operation of deFlorez cracking units using coke drum.

Continuous Counter-Current Treatment

Method Developed at Anglo-Persian Refinery Has Several Advantages Over Previous Processes Handling Various Grades of Distillates

By the Chemical Development Staff
Anglo-Persian Oil Co., Ltd.

The continuous countercurrent treatment of oils offers advantages over batch washing which are evident on a priori grounds; thus, such a method of procedure may be expected to result in a better product, or a saving in reagent, or a saving in time, or all three, since the reagent is applied in its most active state to the nearly finished oil, while in its nearly spent condition it is applied to the oil in its raw state, a condition favorable to the complete utilization of the particular chemical material used. In batch working the reagent and the oil fall off simultaneously in activity, which may not only be undesirably great at first, but may later decline so much as to require the use of fresh treating means.

Continuous operation saves much labor, an occasional adjustment in accordance with the reading of a flow meter being, in effect, substituted for the frequent maneuvering of valves, the continual dipping of tanks and measuring vessels, the frequent starting and stopping of pumps, the watching of sight boxes, and similar operations. In addition, the diminution of fire risk and of breathing losses is a consequence of the fact that the plant is always full and always closed. Corrosion may also be eliminated when, as is often the case in batch washing, acid is succeeded by water and by alkali in the same vessel.

A countercurrent plant should be designed to give intimate contact, for any desired time, between oil and reagent; it should function with certainty and be free from parts, such as pumps, that are subject to breakdown and involve high maintenance costs.

Previous Designs

Previous designs of continuous countercurrent washing plants fall into three categories:

1. A tower, in which the heavier liquid is rained down through an ascending column of the lighter liquid, as much contact as possible being obtained by means of devices such as trays with serrated lips or with packing.

2. A series of pump agitated vessels, a proportion of liquid from the vessel next in the series entering the suction of the pump, in addition to the liquids circulated.

3. A series of orifice mixers and tanks with similar cross connections to produce countercurrent flow. In one such system the tanks are closed and worked under pressure, so that a pump at one end transfers the liquid from tank to tank, with consequent pressure drops.

Tower System

The tower system has nothing but its simplicity to recommend it. Contact between the liquids is inadequate, and after the liquids have been metered in their rates of flow are not subject to control. A modification with a central shaft and paddles would produce better contact, but is only practicable in small sizes.

The chief defect of the second system is the inefficiency of pump agitation, which gives only a few seconds' contact per pass, so that if long contact is necessary, large pumps are required. The maintenance and power costs per gallon per hour of contact are much higher with this system than with paddle agitation. In addition, the pump suctions draw both oil and reagent, and the correct mixture is not automatically maintained. Control of the rate of transfer of the liquids in either direction is also a matter of difficulty.

The time of contact in the third case, that is, using orifice mixers, is also very short, and control of flows and mixture composition is difficult. Unless a multiplicity of pumps is used, the system does not lend itself to extended countercurrent working. Plants of this sort have been used in treatments of the simplest type, such as the removal of hydrogen sulphide by alkali, where the action is nearly instantaneous, but where long contact is required their first cost, as well as maintenance, is too high, and their control is difficult.

These advantages and structural features have been realized in the Anglo-Persian Oil company's refineries, where a new type of operation has been developed.

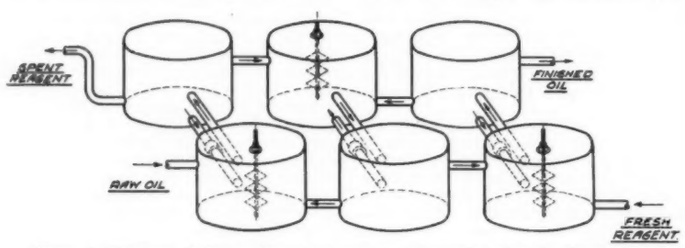

Figure 1—Diagram of the continuous counter current treating plant is shown above.

New Method

The method has been applied to the treatment of straightrun and cracked motor gasoline and all other distillates up to and including heavy kerosene when employing alkaline hypochlorite solution, sulphuric acid or alkali. It has not yet been applied to lubricating oils.

The plant (English Patent 321,200; U. S. A. Patent 373,047) is arranged as a series of pairs of vessels of which one is an agitator and the other a separator, as shown diagrammatically in Figure 1. The oil and reagent are metered in at opposite ends of the series, flowing continuously in countercurrent, and emerging at the ends remote from those at which they respectively entered, the oil being thus alternately agitated with and separated from reagent which becomes progressively stronger from pair to pair. This is effected without the use of pumps by taking advantage of the difference in density of the three liquids, oil, reagent and the emulsified or finely-divided mixture of oil and reagent.

Into a pair of vessels interconnected as shown (Figure 2) the oil and reagent enter the agitator vessel continuously and are stirred into a very intimate mixture. This mixture flows continuously into the separator by the connection at midlevel, and forms two layers.

Inasmuch as the top layer is of lower density than the mixture of oil and reagent in the agitator, its free surface stands higher than that of the mixture. This provides the head necessary to pass forward the oil into the agitator of the next pair of vessels in the series.

In a similar manner, head is produced in the reagent which forwards it in the opposite direction along the series, or by the bottom connection, back in regulated quantity into the agitator whence it came. This bottom connection, with valve, is provided in order to allow any desired ratio of oil to reagent in the agitator to be maintained whatever the rates at which reagent and oil are fed into the plant.

For example, while oil and sulphuric acid may be fed in at rates by volume of 800 and 1 respectively, the ratio of oil to acid in the agitators may be maintained at 4:1 or any other desired ratio.

Maximum Turbulence

To obtain intimate contact, the agitator vessel is designed to give maximum turbulence for a given outlay in power. The vertical paddle shaft is mounted eccentrically in the cylindrical vessel, and carries three diamond-shaped blades set 120 degrees apart in plan.

Complete mixing is obtained without conical bottoms with closely applied blades. Seals are provided where the shafts enter, and at manholes and other

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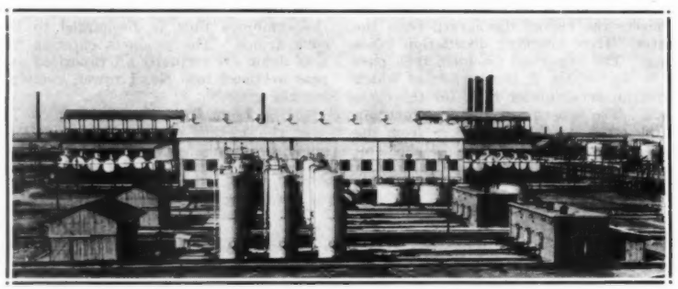


General view of washing area, showing continuous plant in background.

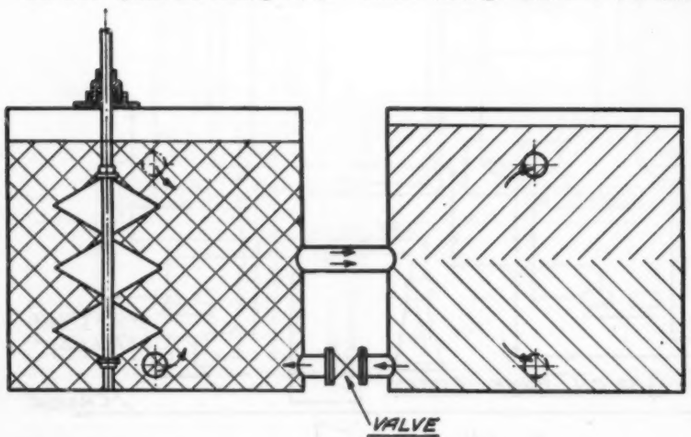
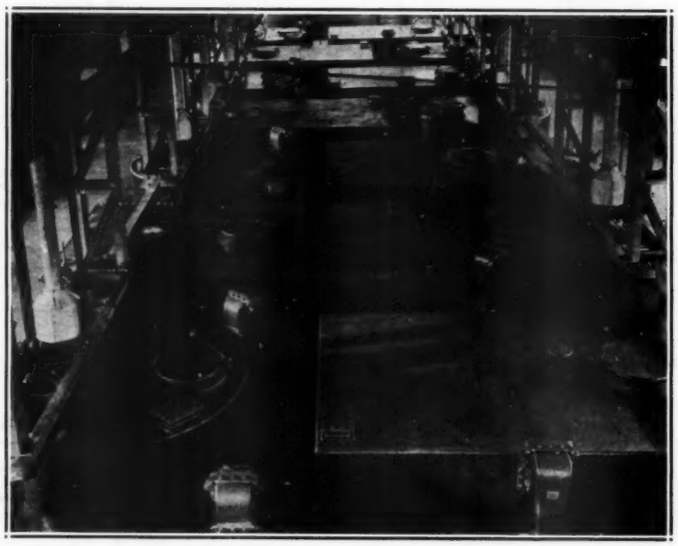
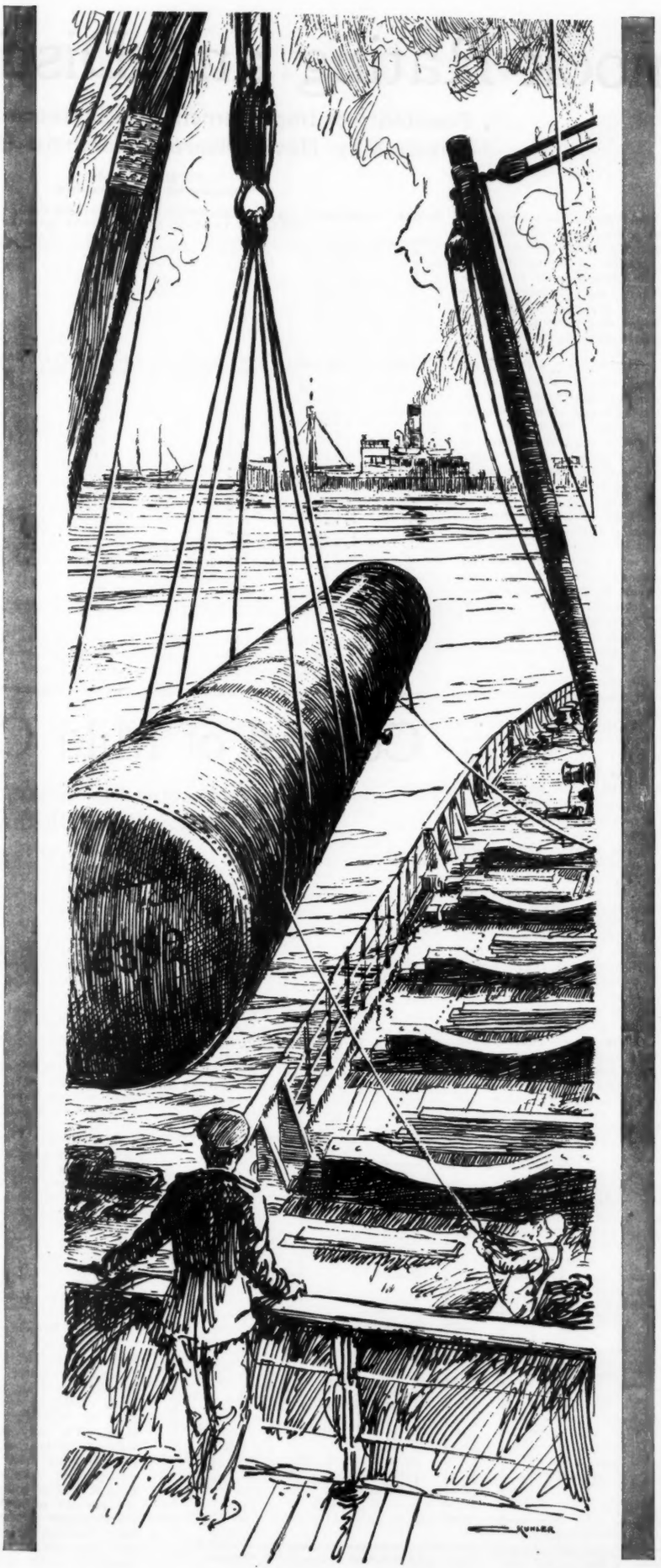


Figure 2—The oil and reagent enter the agitator at the left in the diagram and flow into the separator through the connection at midlevel. Higher level of the liquid in the second tank provides the head required for further movement.



Interior view of continuous kerosene washing plant showing alternative mixing and separating vessels.

A KELLOGG Masterweld bubble tower fabricated of rolled seamless steel cylinders. This tower is for one of a number of Kellogg cracking plants now under construction in foreign oil fields. Sizes of Kellogg Towers are limited only by transportation and unloading facilities.



The M. W. KELLOGG CO.

225 Broadway, New York

LOS ANGELES, 1031 SO. BROADWAY

TULSA. PHILTOWER BUILDING

Knock Rating and Distillation Range

Possibility of Improvement by Eliminating Narrow Cuts Which May Have Disproportionately Harmful Effect

By D. P. Weld
Standard Oil Co. of New York

In recent years the petroleum industry has expended a great deal of effort in order to keep pace with the increasing demand for gasoline of improved knock rating. Of the methods used to accomplish this purpose, the adjustment of the boiling range is, perhaps, the simplest and most obvious way to obtain the best knock rating in gasoline derived from any given stock.

It is well known that a lowering of the distillation range within the limits set by the other necessary characteristics of the gasoline will bring about an improvement in the knock rating. There have also been, from time to time, discussions of the possibility of improving the knock rating of gasoline by the elimination from it of some particular narrow cut or cuts which may affect the knock rating in a disproportionately harmful manner.

An investigation indicating this possibility has been carried out in which the knock ratings of a numerous series of narrow, practically constant boiling fractions taken from a Pennsylvania gasoline were determined.[1] These results, which showed throughout the series of fractions a periodic variation in knock rating, indicate that the Pennsylvania gasoline studied would be considerably improved by the elimination of a number of cuts which showed unusually poor knock ratings.

The separation of a number of narrow cuts would, however, present considerable difficulty in practice.

Project Described

The work which will be described herein was done about two years ago for the purpose of ascertaining the knock ratings of a series of gasolines, representing continuous cuts of various widths taken from different portions of the distillation range of the gasoline in question. The purpose was to find out if any cut or cuts had a particularly large effect upon the knock rating of the gasoline. Each gasoline represented, however, a continuous fraction taken from the parent stock. This project was carried out in the following way.

A raw naphtha produced by liquid-phase cracking of a Mid-Continent gas oil was separated by fractionation into a series of seven fractions. Inasmuch as there was some unavoidable loss in handling the lighter fraction, the whole distillate actually recovered was considered to be the parent stock from which the experimental gasolines were derived. The yields of the various fractions, as well as the yields of the gasolines made by blending the fractions, are, therefore, calculated upon the recovered distillate taken as 100 per cent.

[1] M. R. Fenske, Ind. Eng. Chem., 22, Page 913 (1930).

TABLE 1—SHOWING CHARACTERISTICS OF FRACTIONS USED IN BLENDING GASOLINES OF VARIOUS DISTILLATION RANGES

Designation of fractions	Portion of distillate represented, %	Yield on combined distillate, %	Gravity °A.P.I.	10% point °F.	20% point °F.	50% point °F.	90% point °F.
1	0.0-10.0	10.0	85.4	95	98	106	134
2	10.0-19.1	9.1	73.2	145	148	155	178
3	19.1-28.2	9.1	67.2	169	171	178	200
4	28.2-75.1	46.9	54.3	246	251	272	317
5	75.1-81.1	6.0	43.8	360	363	369	392
6	81.1-93.1	12.0	42.7	377	380	387	408
7	93.1-100.0	6.9	41.3	397	399	405	417

TABLE 2—SHOWING CHARACTERISTICS OF GASOLINES MADE BY BLENDING FRACTIONS FROM CRACKED DISTILLATE

Designation of gasolines	Cut from gasoline A represented, %	Gravity °A.P.I.	Octane number	10% point °F.	20% point °F.	50% point °F.	90% point °F.
A	0.0-100.0	55.9	55	179	201	274	387
B	0.0-93.1	57.3	56	178	197	266	367
C	0.0-81.1	59.8	60	171	188	246	328
D	0.0-75.1	60.9	61	170	185	236	311
E	10.0-100.0	53.4	54	212	229	285	380
F	10.0-93.1	54.8	54	209	224	277	370
G	10.0-81.1	56.9	57	205	217	257	330
H	10.0-75.1	58.0	58	198	212	248	314
I	19.1-100.0	51.8	52	234	248	300	386
J	19.1-93.1	52.6	53	234	248	289	372
K	19.1-81.1	54.9	55	226	236	268	337
L	19.1-75.1	56.0	57	221	230	258	315
M	28.2-100.0	50.0	50	256	270	313	385
N	28.2-93.1	50.9	51	254	266	303	374
O	28.2-81.1	53.0	54	247	256	282	340
P	28.2-75.1	54.2	56	241	248	270	317

The characteristics and the yields of the seven fractions obtained are indicated in Table 1.

The seven fractions were combined in such a way as to produce a number of gasolines whose distillation ranges would cover systematically the distillation range of the gasoline produced by blending all the fractions. In all cases the fractions used in making a particular gasoline were blended in the proportions in which they were obtained in the original distillation. No attempt was made to determine the knock ratings of the individual fractions because they all showed distillation ranges entirely different from that of a normal gasoline. Table 2 shows the characteristics of the various gasolines, including Gasoline A, which contains all the fractions and is considered to be the stock from which all the other gasolines were derived.

Figure Explained

The accompanying figure shows the various interrelationships between the position and width of the cuts represented by the gasolines, their 10 and 90 per cent points, and their knock ratings expressed as octane numbers. The solid horizontal lines show upon the right-hand scale the

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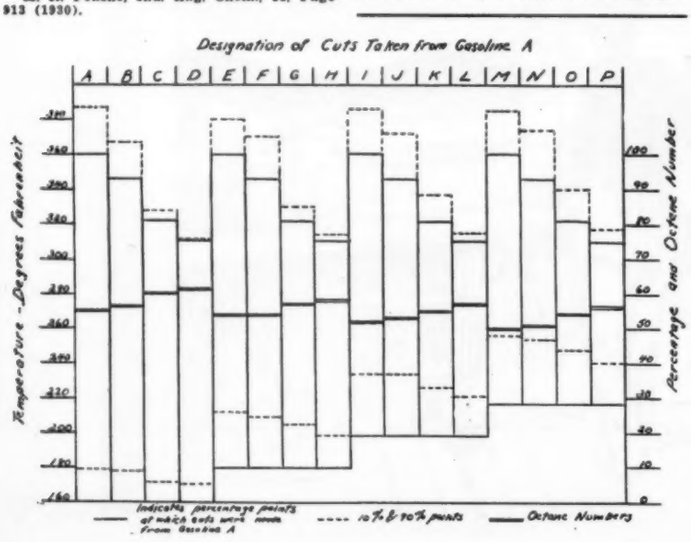

Designation of Cuts Taken from Gasoline A
A B C D E F G H I J K L M N O P
Temperature - Degrees Fahrenheit
Percentage and Octane Number
Indicates percentage points of main cuts when made from Gasoline A
10% & 90% points
Octane Numbers

Control of Mild Cases of Corrosion

Usually Accepted as Normal but They Can Be Reduced Many Per Cent With Ultimate Saving to Entire Industry

By L. J. Catlin
Chief Chemist, Standard Oil Co. (Kansas)

The familiar axiom that violent cases require vigorous treatment, might be followed by corollary No. 1, to the effect that mild cases are usually accepted as normal, and not given any attention. The appearance of highly corrosive crudes at refineries in recent years may in one respect be looked upon as a blessing because it has forced attention to the problem of combating corrosion, and furnished a problem of magnitude sufficient to allow quantitative study without the use of microscopic methods. And when we reflect that it is no doubt possible to reduce the normal rate of corrosion from normal crude by at least a few, and perhaps many per cent, we can even see an ultimate saving to the entire industry from the necessity of running highly corrosive crudes.

It is the purpose of this article to sketch briefly, from the laboratory standpoint, a few suggestions on detecting mild cases of corrosion, and to outline at least one simple method of correcting it, as applied to running crude oil.

Laboratory examination often gives an indication of the corrosive properties of crude oil. Sufficient has been said in the literature of the last few years to point out the importance of chlorides as producers of hydrochloric acid in vapor systems. It has been shown that magnesium chloride is the principal offender in this respect. Calcium chloride is corrosive to a lesser extent, but when it predominates it is more likely to cause trouble by rapidly crystallizing, and, in the case of shell stills where there is little turbulence, adhering to the metal and causing hot spots. Sodium chloride does not cause corrosion and does not settle appreciably till the coking stage of distillation, when it accumulates largely in the crust next to the shell of the coke still.

Presence of Salts

The presence of these salts may always be attributed to the presence in crude of salt water. Very few crudes are entirely free from salt water, and often these emulsions are so highly dispersed that the centrifuge test fails to reveal them. The only way to eliminate this water is by heat, and this would not be feasible aside from the regular distillaiton process. The amount of actual salt present will of course depend both upon the amount of water present, and the concentration of the solution in the water. Looking over records on regular pipe line crude ranging in gravity from about 35° to 40° A.P.I., through a period of about five years we find the percentage of salt varying between .02 per cent and .10 per cent by weight, with only two or three cases of a negative test for salt. No attempt was made in these cases to determine what percentage of this salt was corrosive, but presumably a portion of all of it was magnesium chloride, as it is seldom entirely absent in concentrated salt solutions. To compare with these we have tests from 40 or 50 samples gathered from different points where this same pipe line crude was gathered, covering a wide range of territory in Kansas, Oklahoma and Texas, in which the amount of salt ranges from zero to .143 per cent. A still further comparison is found in the record of about 20 samples from a field producing so-called highly corrosive crude, in which the amount ranges from .03 per cent to .310 per cent salt.

The results recorded above were obtained by a special test developed for the purpose, which is perhaps not entirely accurate, but if it is in error it is probably too low. It was found that carbon disulphide would completely separate water from oil in these emulsions, and that the water would not pass through a gooch filter which was wet with the oil or disulphide. Even crystalline salts are sufficiently insoluble in the disulphide to cause no trouble, and practically the only inaccuracy of the test is the mechanical inaccuracy of the filter, which can be made negligible. Accordingly, a relatively small amount of oil is mixed with 5 to 10 times its volume of carbon disulphide and this passed through a gooch filter. The filter is then dried at a moderate temperature, preferably below 212° F. for several hours, and the salt weighed dry.

More Accurate Method

A more accurate method which may be applied here was published by Ralph R.

(Continued on Page 202)

New Developments in Knock Rating

Secondary Standards Offer Convenient and Economical Method of Determining Octane Numbers of Motor Fuels

By Graham Edgar
Research Laboratories, Ethyl Gasoline Corp.

STANDARDIZATION OF ANTIKNOCK TESTING

Despite the tremendous importance of antiknock fuels, there has existed until quite recently in the petroleum industry the utmost divergence in methods of measurement of antiknock value and in methods of expressing and reporting the results of test. In view of the rather general lack of understanding of the nature of the problems involved, the author, in accompanying discussion, outlines some of the methods which have been employed in measuring antiknock value and discusses the significance of "antiknock scales."

Following are the author's conclusions:

1. All antiknock ratings are essentially comparisons of one fuel with another under given conditions in an engine.

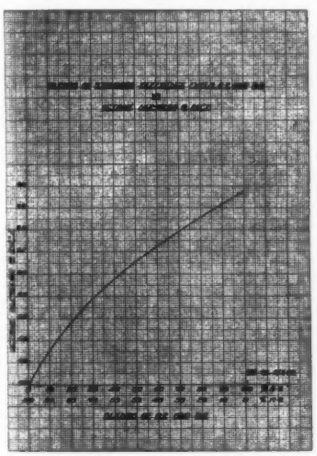
2. Primary fuel standards, consisting of pure hydrocarbons, are necessary to establish a reproducible and generally understood scale for reporting antiknock measurements.

3. Normal heptane and iso-octane have now been officially recommended as primary standards, and all antiknock results should be expressed in "octane numbers."

4. Secondary standards, calibrated against heptane-octane blends are convenient and economical for routine determination of octane numbers.

It should be emphasized that all practical methods of measuring antiknock value consist essentially in comparing one fuel with another in an engine. The knock is affected by so many factors—engine design, throttle opening, air fuel ratio, spark advance, jacket temperature, carbon deposits, oil temperature and consumption, barometric pressure, air temperature, humidity, etc.—that it is not possible to obtain an absolute knock rating in any engine on a single fuel, except by comparing it with some other fuel whose charcteristics are known. Many, many ways have been employed in making such comparisons.

Perhaps the simplest way of comparing two fuels is to put them into an automobile and drive them successively up a steep hill, noting the speed at which the knock comes in or goes out with the fuels in question. An automobile, however, is seldom a very precise instrument of measurement. Unless such a test is carried out under very carefully controlled conditions, exact fuel comparisons cannot



be expected. Furthermore, the test is complicated, in any multicylinder engine, by uncertainty in the evenness of distribution among the cylinders. For this reason all designers of accurate knock testing engines have developed single cylinder testing equipment, capable of being operated under carefully controlled conditions and unaffected by distribution problems.

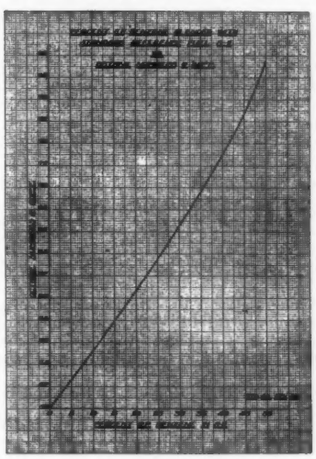
With such equipment, the antiknock value of two fuels may be compared in a variety of ways, all of which, however, fall into two main classes:

(a) One of these classes compares two fuels by operating them successively in an engine and finding out how much variation must be made in some engine factor to make the two fuels knock equally. The variable engine factor may be throttle opening, compression ratio, spark advance, speed or load, the attempt being made to vary only one factor at a time. The results of such tests are then obtained in terms of some engine variable. Thus Fuel A may knock at a 10 degree spark advance and Fuel B at 15 degrees on the particular engine. Fuel A may knock at 5-to-1 compression ratio and Fuel B at 5.4-1. Some of these methods are more accurate or convenient than others, but all of them have the characteristic that they give results in terms of some engine variable, although the engine is usually calibrated with some reference fuels and the results reported in terms of such fuels.

(b) Another class of methods consists in measuring the antiknock value of a fuel by comparing it directly, under fixed engine conditions, with a series of fuel standards of known antiknock values, until a fuel is found which knocks equally with the fuel under test. The results are then expressed in terms of the composition of the standard fuel.

Knock Rating Scales

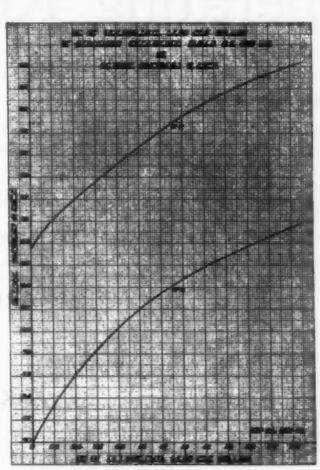
The fact that antiknock measurements are always comparisons of one fuel with another, and are not measured in absolute engine units, has led in the past to



much confusion in methods of reporting knock ratings. The usual practice is for a given laboratory to set aside some arbitrary sample of gasoline as a standard of comparison, and rate other fuels in terms of this particular standard. Many laboratories report knock ratings in terms of the per cent of benzol which must be added to the reference fuel to make it equal to the fuel in question. Other laboratories report the amount of tetraethyl lead or aniline which must be added to the reference fuel to make it equal to the unknown sample (where the reference fuel is worse than the sample), or the amount that must be added to the sample to make it equal to the reference fuel (where this is better than the standard). Some laboratories convert these data into some arbitrary numerical scale and report knock ratings by a number on such scale.

All of these methods are reasonably satisfactory when the laboratory is reporting to some one who understands exactly the nature of the particular fuel, the method of comparison, and the scale employed; they have, however, absolutely no significance to anyone not acquainted with these fuels. The practice has resulted in a widespread use of terms with no absolute meaning whatever. Thus we frequently see the statement that a certain gasoline has a "40 per cent benzol equivalent."

Actually this means that by some method of testing, it was necessary to add 40 per cent of benzol to some particular reference fuel to make it equal the sample in antiknock value. Since the characteristics of the reference fuel are entirely unknown, the statement in question merely means that the testing laboratory was using a reference standard much worse than the sample in antiknock value. If other reference gasolines had been used, the "benzol equivalent" might have been



60 per cent or 0 per cent.

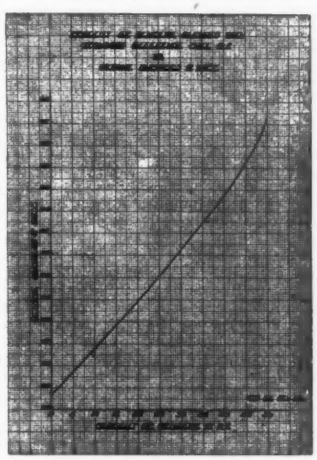
The lack of meaning of such methods of reporting results has emphasized the need of uniform primary standards of antiknock value, reproducible and constant, by means of which antiknock values may be expressed in terms intelligible to everyone.

Primary Standards

Primary standards of antiknock value must be entirely reproducible at any time, and chemically pure hydrocarbons seem the only substances entirely satisfactory. It is necessary to have one hydrocarbon lower in antiknock value than any fuel likely to be tested, and one higher in antiknock value than any likely to be tested. Mixtures of such hydrocarbons form a reproducible scale of antiknock value, capable of being understood by anyone.

In 1926 the writer[1] proposed the use of normal heptane (C_7H_{16}) and iso-octane (C_8H_{18}—chemically named 2,2,4-trimethylpentane) as primary standards for reporting antiknock ratings. Pure normal heptane has a much greater tendency to knock than any commercial gasoline, while iso-octane has much less tendency to knock than any commercial gasoline. The two hydrocarbons have the advantage that they are nearly alike in physical properties, differeing little in gravity, viscosity, boiling point, etc.

During the last two years the subject of knock testing has been studied inten-



sively by a subcommittee on detonation of the Co-operative Fuel Research Steering Committee, and after giving careful consideration to a number of proposed primary standards[2], the subcommittee finally recommended the use of heptane and iso-octane. A few months ago the Co-operative Fuel Research Steering Committee recommended to the industry that all knock ratings should be expressed in "octane numbers," the octane number of a fuel being defined as the "percentage by volume of iso-octane in blends of this substance with normal heptane necessary to equal the antiknock value of the fuel in question." This action was later approved by the Standards Committee of the Society of Automotive Engineers, so that the use of octane numbers is now recommended practice in the automotive industry as well as the petroleum industry.

A universal language in reporting antiknock ratings is, therefore, at last available, and this should go far to clear up the existing confusion involved in the use of arbitrary individual scales.

Standard Test Methods

It is well realized that even the comparison of two fuels in a knock testing engine is influenced to a certain extent by the same variables that influence the

(Continued on Page 229)

[1] Edgar, "Measurement of Knock Characteristics of Gasoline in Terms of a Standard Fuel," Ind. Eng. Chem. 19, 145, (1927).

[2] Campbell, Lovell and Boyd, "Detonation Characteristics of Some of the Fuels Suggested as Standards of Antiknock Quality," J. Soc. Automotive Eng. 26, 163, (1930).

Record Number of Operating Refineries

Annual Survey Shows 388 Active Plants in United States March 1. Cracking Capacity Nears 2,000,000 Bbls. Daily

By Robert C. Conine

Petroleum refiners in the United States during a year of retrenchment within the industrial world, have enlarged and improved their plants, the total expenditures being at least as great as in any 12-month period in the history of the oil industry.

The Oil and Gas Journal's 1931 Survey of Petroleum Refineries in the United States which is published complete in this issue, shows a record number of operating refineries with several new plants constructed during the year and a substantial gain in the number and capacities of cracking plants, with a general improvement in all other phases of plant operation. Similar conditions are indicated in Canada in The Oil and Gas Journal's first complete survey of refineries in that country.

Faced with the necessity of securing large yields of quality products at the lowest possible costs due to exceptionally keen competitive conditions, refinery operators as a group have continued to strive for maximum efficiency at their plants. Even in cases where there has been no expansion in rated capacities of manufacturing facilities, most refiners have found it expedient to improve operating methods and many millions of dollars have been spent in replacing obsolete units with manufacturing equipment of the latest design.

To keep pace with their growth in the crude oil producing and marketing branches, three major companies have built new refineries in the principal consuming areas. In addition there have been the usual number of new plants in flush oil fields built by the smaller companies.

Part of the growth in plant facilities has been due to a number of major mergers. In order to correlate their consolidated operations, these refiners in most cases have completed and are now making many changes at their plants. It is probable that this phase of refinery growth will increase in importance during the coming year.

Steady Expansion

The steady development of the refining industry is clearly reflected in the accompanying tables which summarize the 1931 survey with comparative data for previous years. On March 1 of this year there were 388 operating refineries in the United States, an increase of 26 over March 1, 1930, and three greater than the number operating on March 1, 1925, when the previous record was established. The figures on operating refineries include a few small plants which were temporarily shut down on the dates indicated.

In the period of March 1, 1930, to March 1, 1931, 21 refineries installed cracking equipment to bring the total daily cracking capacity of plants in the United States to 1,828,959 bbls. This represents an increase in daily cracking capacity of 123,660 bbls. Only those plants which are in operation are listed. These number 207.

The total daily capacity of the 388 operating refineries in the United States is 3,859,180 bbls. This figure is raised to 4,110,000 if the capacities of shutdown plants, numbering 103, is added. A study of The Oil and Gas Journal's survey will show, however, that the increased efficiency of refineries calls for a readjustment of the values involved in figures of daily crude oil capacity. It will be seen that the greatly increased demand for motor fuel has not made necessary a commensurate expansion in capacities, and this is a reflection of the refiners' success in increasing the percentage yield of gasoline from crude oil.

However, construction of new refineries will figure quite as prominently as in the period reviewed in the 1931 survey of The Oil and Gas Journal, and no letup is seen in expansion work. All of the evidence points to a continued progress of the refining industry and the increase in total daily capacity during the period of March 1, 1930, and March 1, 1931, is 137,820. This is significant in the light of the indication given in the 123,660-bbl. increase in daily cracking capacity.

The progress which has been made in the method of obtaining gasoline by cracking the heavy residual oils from skimming plants is strikingly shown by the following facts. Although crude oil runs to stills during the year ending January 1, 1931, were 60,261,000 bbls. less than for the 12-month period ending January 1, 1930, the production of gasoline was increased by 1,139,000 bbls. The quantity of gasoline produced by the various cracking processes during the later period was 20,516,000 bbls., while the manufacture of straightrun and natural gasoline during this time declined by 19,377,000 bbls.

The survey also shows that refiners, as a whole, are seeking to take more from the crude oil than has been their policy in the past. It will be seen that many operators have made installations for the manufacture of lubricating oils, asphalts and wax, while others have added specialties, ranging from insecticides and special soaps to paint ingredients and solvents, to the list of commodities produced at the refineries.

It will be noted that in the list of shutdown plants, 15 have been stricken from the tables. These plants were wholly or partially dismantled during the year. The total daily capacity of these plants is 35,750 bbls. The total daily capacity of plants listed as shut down in the 1930 survey, but which have resumed operations, totals 15,900 bbls. The 103 refineries listed in the shutdown columns of this review have a total daily capacity of 251,200 bbls.

In this connection it should be pointed out that the average daily capacity of the shutdown plants is slightly less than 2,440 bbls., indicating that a majority of the refineries which have closed down are small plants, in view of the fact that 14 of the 103 shutdown refineries represent 131,000 bbls. of the total daily capacity of these plants. This leaves 1,345 bbls. as the average daily capacity of the remaining shutdown plants.

New Refineries

Gulf Refining Co. is completing refineries at Toledo and Cincinnati, Ohio, and at Pittsburgh, Pa. The Ohio refineries each have a daily capacity of 12,000 bbls.

RECAPITULATION

TABLE 1—GROWTH IN PETROLEUM REFINING (1914-1931)

Year—	Total number of refineries	Total crude capacity bbls. daily	Number of operating refineries	Capacity operating refineries bbls. daily	Number refineries with cracking process*	Cracking capacities bbls. daily
1914	176	.....	...	.....	...	.....
1918	267	1,186,155	...	.....	...	.....
1919	289	1,295,115	...	.....	...	.....
1920	373	1,530,565	...	.....	...	.....
1921	415	1,888,800	...	.....	...	.....
1922	479	2,164,050	325	1,854,590	...	.....
1924	574	3,046,790	362	2,549,490	...	.....
1925	584	3,033,682	385	2,680,052	(†)	(†)
1926	515	3,068,340	356	2,770,340	150	980,960
1927	462	3,224,307	328	2,964,427	158	1,245,890
1928	456	3,426,330	315	3,116,930	148	1,327,584
1929	463	3,719,550	341	3,454,250	170	1,487,950
1930	479	3,972,460	362	3,721,360	186	1,705,299
1931	491	4,110,380	388	3,859,180	207	1,828,959

*Operating refineries only. †Not available previous to 1926. Note: The reports from 1924-1930, inclusive, were compiled by The Oil and Gas Journal and the remainder by government bureaus.

Survey of Operating Refineries in United States

Personnel and Plant Data

ABBREVIATIONS USED IN TABLES

Complete plant (Comp.)—Gasoline, kerosene, gas oil, fuel oil, lubricating oils, paraffin wax, petroleum coke, asphalt or both coke and asphalt, usually includes cracking. Some plants listed as complete do not manufacture asphalt or coke.
Skimming plants (S)—Gasoline, kerosene, gas oil and fuel oil.
Skimming and lub (S&L)—Gasoline, kerosene, gas oil, fuel oil and lubricating oils.
Skimming and asphalt (S&A)—Gasoline, kerosene, gas oil, fuel oil and asphalt.
Skimming, lub and asphalt (SL&A)—Gasoline, kerosene, gas oil, fuel oil, lubricating oils and asphalt.
Asphalt plant (A)—Distillates, gas oil, fuel oil and asphalt.
Topping plant (T)—Tops, distillates, gas oil and fuel oil.
Cracking (C)—Same products as skimming.
Wax plant (Wax)—Gasoline, kerosene, gas oil, fuel oil, lubricating oils and paraffin wax.
Lub plant (L)—Gas oil, fuel oil and lubricating oils.

MAILING ADDRESS

With the exception of the plant superintendents, chief engineers and chief chemists, the mailing address of the company personnel listed in this report usually is

ARIZONA

Name and general offices—	President	Vice President	Secretary	Treasurer	Purchasing Agent
Rio Grande Oil Co., 417 S. Hill St., Los Angeles, Calif.	See California	See California	See California	See California	See California

ARKANSAS

Berry, James B., Sons Co. of Ill., 6 N. Michigan Ave., Chicago[1]	J. D. Berry	C. E. Miller	H. B. Pullar		
Henry H. Cross Co., 123 S. Michigan Ave., Chicago, Ill.	H. H. Cross	George F. Fox*			George F. Fox
Houston Oil Co. of Texas, Petroleum Bldg., Houston, Tex.[2] ...	E. H. Buckner	L. S. Zimmerman	A. H. Kennerly	L. S. Zimmerman	M. L. Clark
Kettle Creek Refining Co., El Dorado[2]	W. B. Hassett*	S. H. Fredericks	W. E. N. Phillips	W. B. Hassett	
Lion Oil Refining Co., Exchange Bldg., El Dorado[3]	T. R. Barton	T. M. Martin	J. A. Crenshaw	T. H. Barton	R. E. Meinert
Macmillan Petroleum Corp., 530 W. Sixth St., Los Angeles, Calif.[4]	R. S. Macmillan	Alfred Macmillan	Joseph Zeppa	Joseph Zeppa	
Ouachita Valley Refining Co., El Dorado[5]	John E. Shatford*	Edward V. Stockham	E. B. Wall	C. L. Crenshaw	John E. Shatford
Root Refining Co., Commercial Nat'l Bank Bldg., Shreveport, La.[6]	D. P. Hamilton*	H. Canon	T. E. Beaird	L. C. Hallenquist	T. E. Beaird
Simms Oil Co., 1007 Magnolia Bldg., Dallas, Tex.	See Texas	See Texas	See Texas	See Texas	See Texas
Union Asphalt Co., El Dorado	J. B. Sowell	E. F. O'Bryne	L. A. Rankin	L. A. Rankin	L. A. Rankin

*General manager.
[1]Berry, James B., Sons Co.: H. B. Pullar, chief chemist.
[2]Kettle Creek Refining Co.: Cracking plant shut down since June 1, 1930.
[3]Lion Oil Refining Co.: M. E. Wilson, E. D. Ellison, vice presidents; W. A. Carney, chief chemist.

and are equipped with cracking units of the Gulf type with daily capacities of 6,000 bbls. The new Gulf refinery at Pittsburgh is a 6,000-bbl. skimming plant with cracking facilities with a daily capacity of 3,000 bbls. Pure Oil Co. completed an 8,000-bbl. skimming and cracking plant at Toledo, Ohio. The cracking unit has a daily capacity of 3,600 bbls. The Continental Oil Co. built a 1,500-bbl. refinery at Denver, Colo.

Texas Leads

Development of new oil areas in Texas has been followed by the construction of a number of small skimming plants, and plans for the construction of four more refineries during 1931 have been announced. Leadership in the refining field is retained by this State in which the total daily crude capacity of its plants is 867,950 bbls., and the total daily cracking capacity, 538,650 bbls. The comparatively low cost of producing crude oil in the new fields, where it is pointed out that a well can be drilled at a tenth of the cost of a well in the Oklahoma City Field and a twentieth of the cost of a Kettleman Hills, Calif., well, is expected to prove a strong incentive to refiners during 1931. Seven refineries in Texas added cracking units.

Ten new refineries were built in California, the largest having a daily crude capacity of 6,000 bbls., and the smallest, 50 bbls., with the average at 2,315 bbls. Five California refineries added cracking facilities to their equipment, bringing the daily cracking capacity for the State to 196,800 bbls. from 160,000 bbls. The total daily crude capacity for the State is 898,450 bbls. It will be noted that in respect to daily crude capacity of its plants, California leads Texas.

In Oklahoma, six refineries have been erected to skim the high gravity crude oil produced in the Oklahoma City Field. These plants, however, are encountering difficulties as a result of proration regulations in effect in the field and marketing connections, so that they are running intermittently. The total daily crude capacity of plants in Oklahoma is 329,200 bbls., giving it third place among the states. The daily cracking capacity of its plants is 119,150 bbls. Two plants installed cracking facilities during the year.

The cheap crude oil available in Montana has promoted a steady advance in refinery operations in that State in spite of the additional outlay of expense involved in the treating process required by the high sulphur content of the oil. During the period reviewed two Montana plants added cracking units to their equipment. It is expected that if the State authorities decide to allow a higher permissible percentage of sulphur content, refining activities will show a substantial increase during 1931. State officials are sponsoring tests to determine the feasibility of raising the sulphur requirement.

TABLE 2—1931—REFINING CAPACITY IN THE UNITED STATES; RECAPITULATION BY STATES

(Capacities given in barrels daily)

State—	No. of plants	Daily crude capacities	Plants operating	Capacity operating plants	Shutdown plants	Capacity Plants with shutdown refineries	cracking facilities	Cracking capacities
Arizona	2	1,500	1	1,000	1	500	...	.....
Arkansas	12	60,000	10	58,500	2	1,500	7	21,250
California	70	953,450	55	898,450	15	55,000	16	196,800
Colorado	4	5,600	4	5,600	...	.....	3	3,800
Georgia	2	9,000	2	9,000	...	.....	1	3,600
Illinois	13	146,200	11	140,500	2	5,700	8	85,200
Indiana	7	190,100	5	187,000	2	3,100	5	121,000
Iowa	1	1,500	...	.....	1	1,500	...	.....
Kansas	21	151,700	15	141,500	6	10,200	14	88,200
Kentucky	11	30,650	8	26,750	3	3,900	7	13,600
Louisiana	17	240,230	10	181,330	7	58,900	6	94,800
Maryland	4	57,000	3	50,000	1	7,000	2	45,997
Massachusetts	2	43,000	2	43,000	...	.....	2	28,300
Michigan	6	16,100	5	14,600	1	1,500	1	3,900
Missouri	3	24,500	2	21,500	1	3,000	2	16,000
Montana	23	34,200	20	32,250	3	1,950	4	5,500
New Jersey	9	313,000	9	313,000	...	.....	7	183,037
New Mexico	7	6,350	4	4,000	3	2,350	...	.....
New York	4	40,500	4	40,500	...	.....	3	13,000
Ohio	16	103,450	14	102,200	2	1,250	9	37,650
Oklahoma	65	369,600	47	329,200	18	40,400	31	119,150
Pennsylvania	50	253,850	43	248,550	7	5,300	19	94,000
Rhode Island	2	11,500	2	11,500	...	.....	1	6,000
South Carolina	1	15,000	1	15,000	...	.....	1	20,444
Tennessee	3	1,250	...	.....	3	1,250	...	.....
Texas	111	911,250	90	867,950	21	43,300	45	538,650
Utah	2	7,000	2	7,000	...	.....	1	8,900
Virginia	1	1,500	1	1,500	...	.....	...	.....
Washington	2	1,500	...	.....	2	1,500	...	.....
West Virginia	5	14,500	5	14,500	...	.....	4	13,181
Wyoming	15	95,400	13	93,300	2	2,100	8	67,000
Total	491	4,110,380	388	3,859,180	103	251,200	207	1,828,959

Enlarged Operations

Among the refiners who increased the capacities of their plants during the period under review are the following:

Phillips Petroleum Co. raised the capacity of its Borger, Tex., plant from 12,000 bbls. daily to 25,000 bbls. Other increases in Texas were: Crown Central Petroleum Corp., which raised the capacity of its Houston plant from 5,000 bbls. daily to 13,000 bbls.; Magnolia Petroleum Co., which increased the capacity of its refinery at Beaumont from 55,000 bbls. daily to 70,000 bbls.; Sinclair Refining Co., which added 8,000 bbls. to the daily capacity of its Houston plant bringing it up to 31,000 bbls.

Sinclair Refining Co. increased the capacities of its plants at the following places also: At Wellsville, N. Y., where the capacity of its skimming plant was raised to 10,000 bbls. daily from 4,000 bbls.; at Kansas City, Kans., where it increased the daily capacity of its plant from 10,000 bbls. to 11,000 bbls.; at Coffeyville, Kans., where the daily capacity was increased from 8,000 bbls. to 12,000 bbls.; at Marcus Hook, Pa., where the capacity of its plant was increased from 17,000 bbls. to 20,000 bbls. daily.

Standard Oil Co. of Ohio increased the capacity of its refinery at Cleveland from 16,000 bbls. to 20.000 bbls. daily. Empire Oil & Refining Co. raised the daily crude capacity of its East Chicago, Ind., plant from 15,000 bbls. to 25,000 bbls.; Standard Oil Co. of Indiana increased the capacity of its Sugar Creek, Mo., plant to 20,000 bbls. daily from 14,500 bbls. Barber Asphalt Co. increased the capacity of its Maurer, N. J., refinery to 10,000 bbls. daily from 5,000 bbls.

Increases in daily crude capacity by states are shown to be as follows: Pennsylvania added 12,050 bbls. to the daily capacity of its plants; the daily capacity of plants in Indiana was increased by 12,000 bbls.; that of Arkansas 10,500 bbls.; and that of California, 8,000 bbls. Texas showed the greatest increase in this respect with 54,250 bbls. additional daily capacity. Ohio registered the second largest increase with the addition of 17,720 bbls. to the daily capacity of its plants.

Texas Leads

In the number of refineries in each state, Texas is again shown to lead with 90 plants operating and 21 shut down. California follows with 55 plants operating and 15 shut down. Oklahoma is third with 47 operating plants and 18 shut down, and Pennsylvania follows with 43 operating refineries and 7 shut down. Montana now holds fifth place with 20 operating plants and 3 shut down.

In the comparison among the states in

(Continued on Page 225)

Survey of Operating Refineries in United States

Personnel and Plant Data

the general office of the company. The plant superintendents are reached both at the general office and plant address.

CRACKING PROCESSES

Following is a list of cracking processes, including owners and sales representatives.

Burton—Standard Oil Co. of Indiana, 910 South Michigan Avenue, Chicago, Ill.

Cross—Gasoline Products Co., 700 Baltimore Avenue, Kansas City, Mo.; M. W. Kellogg Co., 225 Broadway, New York, N. Y. Latter company controls process covered by Black patents.

Dubbs—Universal Oil Products Co., 310 South Michigan Avenue, Chicago, Ill.

Fleming—M. W. Kellogg, 225 Broadway, New York, N. Y.

Holmes-Manley—The Texas Company, 135 East Forty-second Street, New York, N. Y.

Isom—Sinclair Refining Co., 45 Nassau Street, New York, N. Y.

Jenkins—Jenkins Petroleum Process Co., 844 Rush Street, Chicago, Ill.

Tube & Tank—Standard Oil Co. of New Jersey, 26 Broadway, New York, N. Y.

In addition to the above, there are several processes listed in the following tables which are generally owned by the companies operating the refineries at which they are installed.

Data include plants under construction.

ARIZONA

Name of Company	Plant location	Daily crude capacity	Type plant	Daily crack. capacity	Type cracking unit	Plant superintendent	Chief engineer	Sales Managers: Tank car	Sales Managers: Bulk and service station
Rio Grande Oil Co.	Phoenix	1,000	S	....		Lynn Lockhart*	See California	See California	See California

ARKANSAS

Berry, J. B., Sons Co. of Ill.	Waterloo	1,500	A-L	....		J. W. Smith			
Henry H. Cross	Smackover	6,000	S	....		C. L. Murphy		George F. Fox	George F. Fox
Houston Oil Co. of Texas	Camden	5,500	S-C	2,000	Dubbs	George H. Hartung	F. Y. Hutchinson	J. B. Benson	L. R. Sexton
Kettle Creek Refining Co.	El Dorado	5,500	S-C	2,000	Dubbs	E. M. Gilbert		H. E. Ericson	
Lion Oil Refining Co.	El Dorado	16,000	S-A-L-C	6,000	Burton and Tube Still	J. J. Allinson	J. B. Rogerson	T. M. Martin	T. M. Martin
Macmillan Petroleum Corp.	El Dorado	7,000	L-A	....		DeRalph Frizell		DeRalph Frizell	George W. Downer
Ouachita Valley Refg. Co.	El Dorado	2,000	S-C	750	Dubbs	John E. Shatford		C. L. Crenshaw	
Root Refining Co.	El Dorado	10,000	S-C-L-A	6,000	Dubbs and Root	E. Kimes	R. T. Colquette	D. A. Brown	
Simms Oil Co.	Smackover	3,000	S-C	2,500	Cross	See Texas	See Texas	See Texas	See Texas
Union Asphalt Co.	El Dorado	2,000	A-C	2,000	Pipe Still	R. L. Moore		E. F. O'Bryne	E. F. O'Bryne

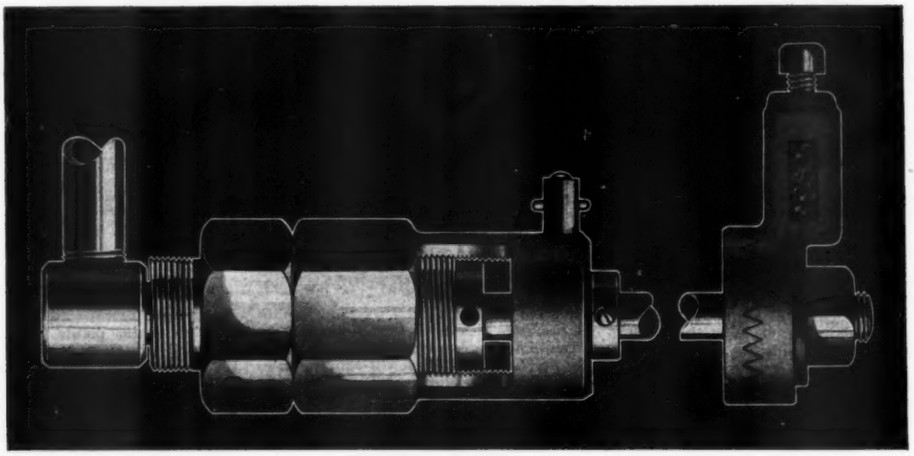
[4]Macmillan Petroleum Corp.: S. M. Patterson, M. P. Macmillan, H. E. Boner, vice presidents; S. E. Campbell, chief chemist.

[5]Ouachita Valley Refining Co.: Cracking Plant shut down.

[6]Root Refining Co.: W. W. Hepburn, vice president; O. E. Day, chief chemist.

[7]Houston Oil Co.: A. H. Standing, general manager.

FISHER makes another Liquid Level Controllers



Fully protected by patents and patents pending

new external ball-bearing stuffing box at no extra cost

This is further evidence of the policy to which Fisher has long been committed: Always to build a better product, and to pass on to the customer the benefits of its research and development work by giving the greatest value per dollar of cost.

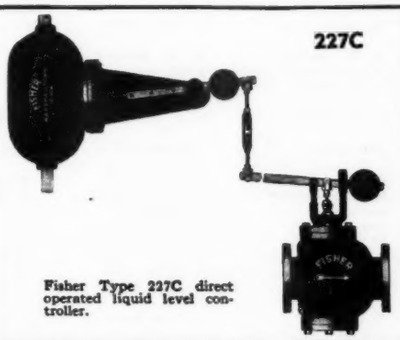
IMPORTANT FEATURES

1. Radial and thrust exterior ball bearings make operation more accurate by eliminating friction and sluggish action. **2.** Greater dependability—sticking is prevented. **3.** Ball bearings cannot corrode because they do not come in contact with float liquid. **4.** Stuffing box is more accessible and requires less attention. **5.** All vital parts are forged stainless steel. **6.** Standard greasing connection provides for complete lubrication of bearings. **7.** Standard packing is used. **8.** Interchangeability on most Fisher rotary stem specialties.

All Fisher Liquid Level Controllers continue to have Stainless Steel Floats at no added cost

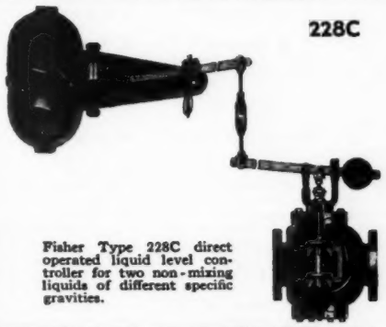
important improvement in

227C



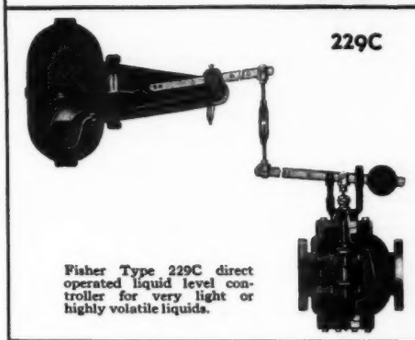
Fisher Type 227C direct operated liquid level controller.

228C



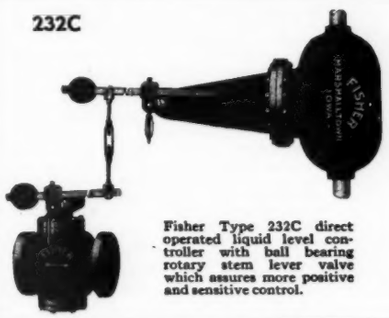
Fisher Type 228C direct operated liquid level controller for two non-mixing liquids of different specific gravities.

229C



Fisher Type 229C direct operated liquid level controller for very light or highly volatile liquids.

232C



Fisher Type 232C direct operated liquid level controller with ball bearing rotary stem lever valve which assures more positive and sensitive control.

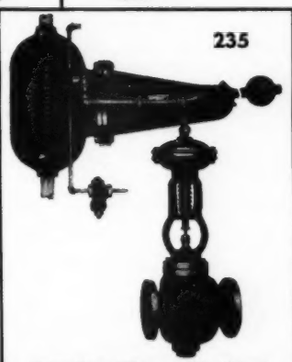
Fisher Liquid Level Controllers have long enjoyed a reputation for accurate and dependable control. That there is a Fisher Liquid Level Controller for every kind of service will be evident from the accompanying illustrations of the various types.

There are many thousands of successful installations on separators, stills, heaters, absorber towers, receivers, condensers, closed tanks, etc., etc.—proving Fisher Liquid Level Controllers dependable and accurate under all conditions.

FISHER GOVERNOR CO.
900 Fisher Bldg. Marshalltown, Iowa

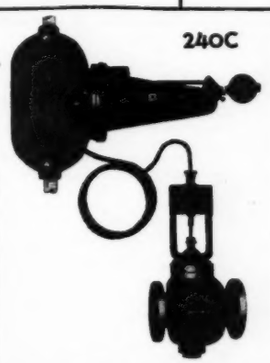
FOR 50 YEARS—

235



Fisher Type 235 remote liquid level controller (pilot valve operated) assures extremely close and positive regulation when as much as 200' separates float cage and main valve.

240C

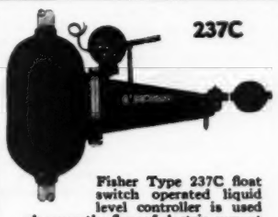


Fisher Type 240C remote liquid level controller assures positive control when the valve is at any distance up to 75' away from the float cage.

220C

Fisher Type 220C float cage is the type 227C liquid level controller without the lever valve. Frequently used to operate special valve, level indicator and other apparatus.

237C



Fisher Type 237C float switch operated liquid level controller is used wherever the flow of electric current must be controlled by a liquid level.

FISHER

THE MARK OF SCIENTIFIC FLUID CONTROL

Survey of Operating Refineries in United States

Personnel and Plant Data

CALIFORNIA

Name and general offices—	President	Vice President	Secretary	Treasurer	Purchasing agent
Andrews, Wm. P., Oil Co., 814 Pacific Southwest Bldg., Long Beach[24]	William P. Andrews*	G. M. Andrews	J. O. Moffett	J. O. Moffett	J. O. Moffett
Andrews, Wm. P., Oil Co., 814 Pacific Southwest Bldg., Long Beach	See above	See above	See above	See above	See above
Associated Oil Co., 79 New Montgomery St., San Francisco[1]	William F. Humphrey	L. F. Bayer	J. P. Edwards	W. A. Sloan	A. P. Mackillop
Associated Oil Co., 79 New Montgomery St., San Francisco[2]	See above	See above	See above	See above	See above
California Northern Corp., 1924 Broadway, Oakland	O. F. Darling*	L. S. Flaherty	H. J. Steiner	H. J. Steiner	
Edington-Witz Refining Co., Ltd., 570 Subway Terminal Bldg., Los Angeles[3]	C. B. Edington	H. J. Witz	R. W. Moore	R. W. Moore	
E. I. Camino Oil Co., Ltd., 1623 N. Miller Ave., Los Angeles[25]	Bertram E. Devere	Marie Devere	Albert Barstow	Marie Devere	Betram E. Devere
Capitol Crude Oil Co., Santa Paula	E. P. Clark		A. E. Smith		
General Petroleum Corp. of California, Higgins Bldg., Los Angeles[4]	J. A. Brown	E. R. Rich	D. W. Woods	F. C. Adams	R. M. Ketchum
General Petroleum Corp. of California, Higgins Bldg., Los Angeles	See above	See above	See above	See above	See above
General Petroleum Corp. of California, Higgins Bldg., Los Angeles	See above	See above	See above	See above	See above
Gilmore Oil Co., Ltd., 2423 E. Twenty-eighth St., Los Angeles[5]	E. B. Gilmore	C. S. Beesemyer*	S. M. Salisbury	C. S. Beesemyer	C. P. Boone
Gilmore Oil Co., Ltd., 2423 E. Twenty-eighth St., Los Angeles	See above	See above	See above	See above	See above
Gilmore Oil Co., Ltd., 2423 E. Twenty-eighth St., Los Angeles	See above	See above	See above	See above	See above
Hancock Oil Co. of California, Security Bldg., Long Beach	Will J. Reid*	George D. Williams	W. N. Reagan	G. P. Deane	W. Westegard
Hercules Gasoline Co., Ltd., 2411 E. Thirtieth St., Los Angeles[6]	A. Mattei*		S. W. Harkleroad	A. Mattei, Jr.	R. E. Hawley
Holly Oil Co., Colorado Springs, Colo.[7]	A. E. Carlton	C. A. Johnson*	R. J. Garritson	R. J. Garritson	S. W. Baker
Kettleman Hills Gasoline Co., Hanford[8]	H. H. Bell	W. G. Phillips*	William Gibson	William Gibson	William Gibson
Lake View Oil & Refining Co., Edwards & Wildey Bldg., Los Angeles	F. C. Skinner*	A. J. Rehwold	Paul J. Hisey	C. F. Powers	
Macmillan Petroleum Corp., 530 W. Sixth St., Los Angeles[9]	R. S. Macmillan	Alfred Macmillan	Joseph Zeppa	Joseph Zeppa	
Olympic Refining Co., 2425 California Ave., Long Beach[10]	C. P. Ritter*	Joseph Tognetti	D. T. Buckley	D. T. Buckley	M. I. Wyatt
Paraffine Co., Inc., 475 Brannan St., San Francisco[11]	R. S. Shainwald	W. H. Lowe*	R. H. Ohea		A. S. Silverstone
Petroleum Specialties, 4021 Bandini Blvd., Los Angeles	O. B. Englisch	Leonard Brown*	John M. Cook	John M. Cook	John M. Cook
Petrol Corp., 4020 Bandini Blvd., Los Angeles	Edwin W. Pauley*		James P. Fitzpatrick	Percy F. Cartzdafner	E. L. Pauley
Petrol Corp., 4020 Bandini Blvd., Los Angeles	See above		See above	See above	See above
Pioneer Paper Co., Fifty-fifth and Alameda Sts., Los Angeles[12]	W. G. Hunt	H. M. Eichelberger	Charles L. Wild	H. M. Eichelberger	A. E. Carlson
Richfield Oil Co., 215 W. Seventh St., Los Angeles	William C. McDuffie, federal receiver in equity.				
Richfield Oil Co., 215 W. Seventh St., Los Angeles	See above				
Rio Grande Oil Co., 417 S. Hill St., Los Angeles[13]	L. E. Lockhart	A. M. Lockhart	L. M. Lockhart*	Charles S. Jones	H. H. Kelly
Rotary Process Refining Co., Ltd., 850 Subway Terminal Bldg., Los Angeles	J. E. Elliott	F. C. Merritt	H. W. Parmalee	H. W. Parmalee	
Shell Oil Co. of California, 100 Bush St., San Francisco[11]	C. Legh-Jones	H. R. Gallagher	A. R. Bradley	John Lauder	J. C. Storey
Shell Oil Co. of California, 100 Bush St., San Francisco	See above	See above	See above	See above	See above
Shell Oil Co. of California, 100 Bush St., San Francisco	See above	See above	See above	See above	See above
Seaside Oil Co., Summerland (Santa Barbara County)	A. M. Heineman	J. F. Bushnell*	M. W. O'Brien	J. F. Bushnell	Edgar Beresford
Seaside Oil Co., Summerland (Santa Barbara County)	See above	See above	See above	See above	See above
Seaboard Petroleum Corp., 2474 E. Ninth St., Los Angeles	A. E. Gibson	J. M. Feldman*	Howard M. Miles	Howard M. Miles	F. J. Burmester
Southwest Refining Co., 3000 Walnut Ave., Long Beach	J. L. Denny		Fred B. Bowe	J. D. Organ*	
Standard Oil Co. of California, 225 Bush St., San Francisco[15]	K. R. Kingsbury	W. H. Berg	J. H. Tuttle	V. F. Palmer	F. P. Summers
Standard Oil Co. of California, 225 Bush St., San Francisco	See above	See above	See above	See above	
Standard Oil Co. of California, 225 Bush St., San Francisco	See above	See above	See above	See above	
St. Helens Petroleum Co., Ltd., 1031 S. Broadway, Los Angeles[16]	H. H. Haldin		A. P. McEachern		W. H. Cowie
Sunset-Pacific Oil Co., Ninth Floor, Pacific-Electric Bldg., Los Angeles[17]	H. L. Carnahan	E. R. Sheldon	Mildred Murphy	E. R. Sheldon	A. V. Halbert
The Texas Company (California), Los Angeles[18]	R. C. Holmes	W. K. Holmes*	E. M. Crone	C. E. Woodbridge	A. F. Colling
The Texas Company (California), Los Angeles	See above	See above	See above	See above	See above
Terra Bella Refining Co., Ltd., Terra Bella	H. P. Mittchel	J. M. Bullard	Frank Stevenson	Frank L. Kennedy	
Union Oil Co. of California, 617 W. Seventh St., Los Angeles[19]	L. P. St. Clair	W. W. Orcutt	John McPeak	J. M. Rust	H. C. Farquhar
Union Oil Co. of California, 617 W. Seventh St., Los Angeles	See above	See above	See above	See above	See above
Union Oil Co. of California, 617 W. Seventh St., Los Angeles	See above	See above	See above	See above	See above
Union Oil Co. of California, 617 W. Seventh St., Los Angeles	See above	See above	See above	See above	See above
Union Oil Co. of California, 617 W. Seventh St., Los Angeles	See above	See above	See above	See above	See above
United States Refining Co., 1001 Board of Trade Bldg., Los Angeles[20]	Carl J. von Bibra	W. A. Kirk	Earl F. Dimond	Earl F. Dimond	F. S. Moore, Jr.
United States Refining Co., 1001 Board of Trade Bldg., Los Angeles	See above	See above	See above	See above	See above
Vernon Oil Refining Co., 2500 E. Twenty-sixth St., Los Angeles	J. A. Brower	E. O. Brower	W. N. Brower	W. N. Brower	
Western Oil & Refining Co., 416 W. Eighth St., Los Angeles[21]	Richard Florian*	R. R. Rakestraw	A. A. G. Scherbel	A. A. G. Scherbel	R. C. McNeal
Western States Petroleum Corp., 114 Sansome St., San Francisco[22]	R. L. Durbrow*	B. F. Garrett	M. C. Lintell	M. C. Lintell	
Wilshire Oil Co., Inc., 2455 E. Twenty-seventh St., Los Angeles	George T. Machris	Alfred P. Machris	Alfred P. Machris		C. S. Hough

*General manager.

[1]Associated Oil Co.: L. D. Jurs, E. L. Shea, W. A. Sloan, vice presidents; L. E. Mittelman, chief chemist; O. P. Cottrell, manufacturing manager; T. O. Edwards, Jr., assistant refinery superintendent; P. E. Allen, manager domestic sales department; E. Whitehead, manager fuel oil sales department; R. S. Turner, manager export sales department.

[2]Associated Oil Co.: F. E. Coyle, general refinery superintendent; F. Harris, assistant refinery superintendent; E. J. Lange, chief chemist.

[3]Edington-Witz Refining Co.: W. A. Shaffer, chief chemist.

[4]General Petroleum Corp.: R. A. Sperry, S. J. Dickey, R. E. Maynard, W. L. McLaine, A. L. Weil, vice presidents; S. J. Dickey, manager of manufacturing; R. A. Sperry, general manager; C. F. Olsen, chief chemist. Vapor phase cracking equipment is shut down.

[5]Gilmore Oil Co., Ltd.: I. Lightner, assistant refinery superintendent; R. Pierson, chief chemist.

[6]Hercules Gasoline Co.: Charles Witt, chief chemist.

[7]Holly Oil Co.: Wiley Blair, Jr., vice president.

[8]Kettleman Hills Gasoline Co.: Charles Crose, chief chemist.

[9]Macmillan Petroleum Corp.: S. M. Batterson, M. P. Macmillan, H. E. Boner, vice presidents; S. E. Campbell, chief chemist.

[10]Olympic Refining Co.: H. W. Batcher, chief chemist, and assistant superintendent of refinery.

[11]Paraffine Co., Inc.: C. E. Green, vice president; O. H. Robertson, chief chemist; E. E. Robertson, assistant refinery superintendent.

[12]Pioneer Paper Co.: J. H. Plunkett, general manager; M. E. Campbell, chief chemist.

[13]Rio Grande Oil Co.: L. M. Lockhart, Charles S. Jones, vice presidents.

COLORADO

Continental Oil Co., Ponca City, Okla.[1]	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma
Continental Oil Co., Ponca City, Okla.	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma
The Texas Company, Houston, Tex.	See Texas	See Texas	See Texas	See Texas	See Texas
Raven Oil & Refining Co., Vernal, Utah[2]	J. W. Leonard	Fred G. Gary	R. A. Bryson*	R. A. Bryson	H. G. Kemp

*General manager.

[1]Continental Oil Co.: Burton process owned by Standard Oil Co. (Indiana).

GEORGIA

Atlantic Refining Co., The, 260 S. Broad St., Philadelphia, Pa.[1]	See Pennsylvania	See Pennsylvania	See Pennsylvania	See Pennsylvania	See Pennsylvania
Mexican Petroleum Corp. of Georgia, 122 E. Forty-second St., New York, N. Y.[2]	See Louisiana	See Louisiana	See Louisiana	See Louisiana	See Louisiana

[1]Atlantic Refining Co.: Footnotes under Pennsylvania.

[2]Mexican Petroleum Corp.: Footnotes under Louisiana.

ILLINOIS

Henry H. Cross Co., 122 S. Michigan Ave., Chicago	See Arkansas	See Arkansas	See Arkansas	See Arkansas	See Arkansas
Henry H. Cross Co., 122 S. Michigan Ave., Chicago	See Arkansas	See Arkansas	See Arkansas	See Arkansas	See Arkansas
Globe Oil & Refining Co. (Illinois), Blackwell, Okla.	I. A. O'Shaughnessy	F. L. Jehle*	G. G. Woodruff	G. G. Woodruff	F. L. Jehle
Indian Refining Co., Inc., Lawrenceville[1]	R. C. Holmes	P. C. Scullin*	E. M. Crone	C. E. Woodbridge	See The Texas Co.
Lincoln Oil Refining Co., Robinson[2]	H. B. Carpenter*	R. E. Luton	E. B. Redpath	F. A. Billstone	C. S. Sherk
Lubrite Refining Corp., 3504 Washington Blvd., St. Louis, Mo.[3]	H. T. Ashton*	W. H. Ware	P. J. Buttles	G. C. Goller	J. H. MacCrea
Red River Refining Co., Inc., 77 W. Washington Blvd, Chicago[4]	Thomas Flynn	E. F. Buchanan	John E. Schulze	E. F. Buchanan	

Survey of Operating Refineries in United States

Personnel and Plant Data

CALIFORNIA

Name of company—	Plant location	Daily crude capacity	Type plant	Daily crack. capacity	Type cracking unit	Plant superintendent	Chief engineer	Sales Managers: Tank car	Sales Managers: Bulk and service station
Andrews, Wm. P., Oil Co.	Long Beach	1,500	S	....		Charles S. Cox	William A. Kirk		Ewell Moffett
Andrews, Wm. P., Oil Co.	Newhall	2,000	A-S-L	....		W. D. Parks	See above		See above
Associated Oil Co.	Avon	58,000	S-L-A-C	10,000	Tube & Tank	W. P. Hugo	H. B. Haney	B. I. Graves	B. I. Graves
Associated Oil Co.	Watson	18,000	S	....		F. E. Coyle	See above	See above	See above
California Northern Corp.	Coalinga	200	L	....		William Powers		L. F. Mikilheim	L. F. Mikilheim
Edington-Wiltz Ref. Co.	Signal Hill	4,500	S	....		William Snowden			
El Camino Oil Co.	Santa Fe Springs	4,000	S	....		Lucas Daams		D. F. Wallace	D. F. Wallace
Capitol Crude Oil Co.	Santa Paula	100	S	....		William Stein	William Stein		
General Petroleum Corp.	Vernon	50,000	Comp.	3,000	Vapor phase	Fred Isaacs	S. J. Dickey	E. R. Rich	E. R. Rich
General Petroleum Corp.	Torrance	35,000	S	....		See above	See above	See above	See above
General Petroleum Corp.	Olinda	2,000	S	....		See above	See above	See above	See above
Gilmore Oil Co., Ltd.	Los Angeles	2,500	S-A	....		H. L. Eggleston	H. L. Eggleston	B. A. Rowell	B. A. Rowell
Gilmore Oil Co., Ltd.	Los Angeles	1,500	S	....		See above	See above	See above	See above
Gilmore Oil Co., Ltd.	Santa Maria	700	S-A	....		See above	See above	See above	See above
Hancock Oil Co. of California	Long Beach	12,500	S-C	500	Hancock	H. D. Tupper	J. Edwards	G. B. Limbocker	G. B. Limbocker
Hercules Gasoline Co., Ltd.	Los Angeles	5,500	S-C	2,500	Jenkins	P. J. Mey	R. M. Hall	S. V. Millington	S. V. Millington
Holly Oil Co.	Huntington Beach	3,000	S	....		J. H. Grimes	J. H. Grimes	C. A. Johnson	
Kettleman Hills Gasoline Co.	Hanford	2,500	S	....		A. B. Scott	Walter Pyne	William Gibson	L. P. Dupron
Lake View Oil & Ref. Co.	Maricopa	3,000	S	....		George E. Holmes			
Macmillan Pet. Corp.	Long Beach	7,500	S	....		L. L. Rebber		S. M. Batterson	George W. Downer
Olympic Refining Co.	Long Beach	5,500	S	....		T. J. Ryan	T. J. Ryan	Philip E. Johnson	Philip E. Johnson
Paraffine Co., Inc.	Emeryville	1,200	A	....		O. H. Robertson	J. T. Coleman		
Petroleum Specialties	Los Angeles	2,000	S	....		William B. Brown		Leonard Brown	Leonard Brown
Petrol Corp.	Los Angeles	6,000	S	....		George E. Miller	E. L. Pauley	Harry Von Zell	Harry Von Zell
Petrol Corp.	Los Angeles	4,000	A	....		See above	See above	See above	See above
Pioneer Paper Co.	Vernon	700	A	....		M. E. Campbell	Henry Wills		
Richfield Oil Co.	Hynes	55,000	S-C	14,000	Cross	A. M. Kelley		J. C. Graves	C. B. Garretson
Richfield Oil Co.	Watson	65,000	Comp.	14,000	Black	See above		See above	See above
Rio Grande Oil Co.	Vinvale	10,000	S-C	2,000	Jenkins	W. Murray		J. N. Reed	J. N. Reed
Rotary Process Ref. Co.	Vinvale	1,000	S-C	500	Rotary	Charles A. Day, Jr.			
Shell Oil Co. of California	Martinez	35,000	Comp.	16,000	Dubbs & Converter	C. O. F. Jenkin			
Shell Oil Co. of California	Watson	64,000	Comp.	47,500	Dubbs	J. F. M. Taylor			
Shell Oil Co. of California	Coalinga	4,000	S	....		C. O. F. Jenkin			
Seaside Oil Co.	Summerland	2,000	A	....		D. C. Peet		J. F. Bushnell	Winslow Bushnell
Seaside Oil Co.	Ventura	4,000	S	....		See above		See above	See above
Seaboard Pet. Corp.	Los Angeles	2,000	S	....		William Rorrison		E. L. Duntley	Howard M. Miles
Southwest Refining Co.	Long Beach	1,000	S	....		Fred B. Bowe		J. L. Denny	J. L. Denny
Standard Oil Co. of California	Richmond	100,000	Comp.	18,200	Richmond, Dubbs	F. H. Smith	Max Thornburg	J. L. Quinn	J. L. Quinn
Standard Oil Co. of California	El Segundo	100,000	Comp.	36,300	Modified Richmond, Dubbs	See above	See above	See above	See above
Standard Oil Co. of California	Bakersfield	25,000	S-A	....		See above	See above	See above	See above
St. Helens Pet. Co., Ltd.	Pico	3,000	S	....		C. Z. Webb	C. Z. Webb	F. R. Sheller	C. N. Collins
Sunset-Pacific Oil Co.	Vernon	8,600	S	....		Frank A. Milliff	M. V. Moulton	E. L. Duntley	H. H. Whitsel
The Texas Company (Calif.)	Los Angeles	30,000	Comp.	5,500	Holmes-Manley	W. J. Ryan		R. T. Herndon	R. T. Herndon
The Texas Company (Calif.)	Fillmore	4,000	Comp.	2,700	Cross	J. R. Scanlin		See above	See above
Terra Bella Ref. Co., Ltd.	Terra Bella	50	L	....					
Union Oil Co. (California)	Wilmington	55,000	S-A-C	21,000	Cross	C. G. Brownlee	L. G. Metcalf	V. H. Kelly	V. H. Kelly
Union Oil Co. (California)	Oleum	30,000	S-A-L	....		A. Roy Heise	See above	See above	See above
Union Oil Co. (California)	Bakersfield	5,000	S-A-L	....		H. M. Ambrosier	See above	See above	See above
Union Oil Co. (California)	Avila	10,000	S-A-L	....		R. W. Frazier	See above	See above	See above
Union Oil Co. (California)	Santa Paula	900	S-A-L	....		C. W. Burtless	See above	See above	See above
United States Ref. Co.	Hynes	5,000	S	....		W. R. Cowan			
United States Ref. Co.	Torrance	1,500	S	....		See above			
Vernon Oil Ref. Co.	Vernon	3,000	S	....		W. G. Darlington		W. N. Brower	P. N. Hinman
Western Oil & Ref. Co.	Wilmington	12,000	S-C	3,000	Jenkins	O. C. Smith	E. J. McKee	A. A. G. Scherbel	A. A. G. Scherbel
Western States Pet. Corp.	Long Beach	5,000	S	....		L. Y. Mattes			
Wilshire Oil Co.	Vernon	25,000	S	....		C. E. Jones			

[11]Shell Oil Co.: W. R. Reinhardt, John Lauder, E. F. Davis, G. H. van Senden, vice presidents; assistant refinery superintendents: D. M. Day, Martinez; I. M. Hemphill, Watson and Dominguez; D. B. Collins, Coalinga.

[12]Standard Oil Co. (California): Oscar Sutro, H. D. Collier, R. W. Hanna, vice presidents; J. F. Brooks, general manager of refineries; J. B. Terry, chief chemist; R. T. Osborn, Richmond refinery manager; A. S. Russell, El Segundo refinery manager.

[16]St. Helens Petroleum Co., Ltd.: Charles Drader, general manager; C. Z. Webb, chief chemist.

[17]Sunset-Pacific Oil Co.: D. L. Mayhew, A. W. Shepherd, vice presidents; O. J. Clark, chief chemist

[18]The Texas Company (California): J. A. Bermingham, R. T. Herndon, C. E. Olmstead, W. S. S. Rodgers, vice presidents.

[19]Union Oil Co. (California): R. D. Matthews, P. N. Boggs, W. L. Stewart, Jr., vice presidents; Dr. D. R. Merrill, manager of research; L. G. Metcalf, manager of refineries.

[20]United States Refining Co.: Controlling interest purchased by Signal Oil & Gas Co.

[21]Western Oil & Refining Co.: A. W. Taylor, vice president; E. J. McKee, construction engineer; J. G. Danforth, chief chemist.

[22]Western States Petroleum Corp.: F. C. Squier, chief chemist; E. E. Greiner, assistant refinery superintendent.

[23]E. I. Camino Oil Co., Ltd.: R. E. Hines, general manager; L. B. Cox, assistant refinery superintendent.

[24]Andrews, William P., Oil Co.; William A. Kirk, general superintendent; H. D. Kayser, chief chemist.

COLORADO

Continental Oil Co.	Florence	3,000	S-C	1,500	Burton	C. R. Tillman	Ray Russell	See Oklahoma	See Oklahoma
Continental Oil Co.	Denver	1,500	S-C	800	Cross	J. E. Fenex	See above	See Oklahoma	See Oklahoma
The Texas Company	Craig	1,000	S-C	1,500	Holmes-Manley	G. O. Shefstead	See Texas	See Texas	See Texas
Raven Oil & Ref. Co.	Rangely	100	S	....		M. M. Cook	M. M. Cook	H. G. Kemp	H. G. Kemp

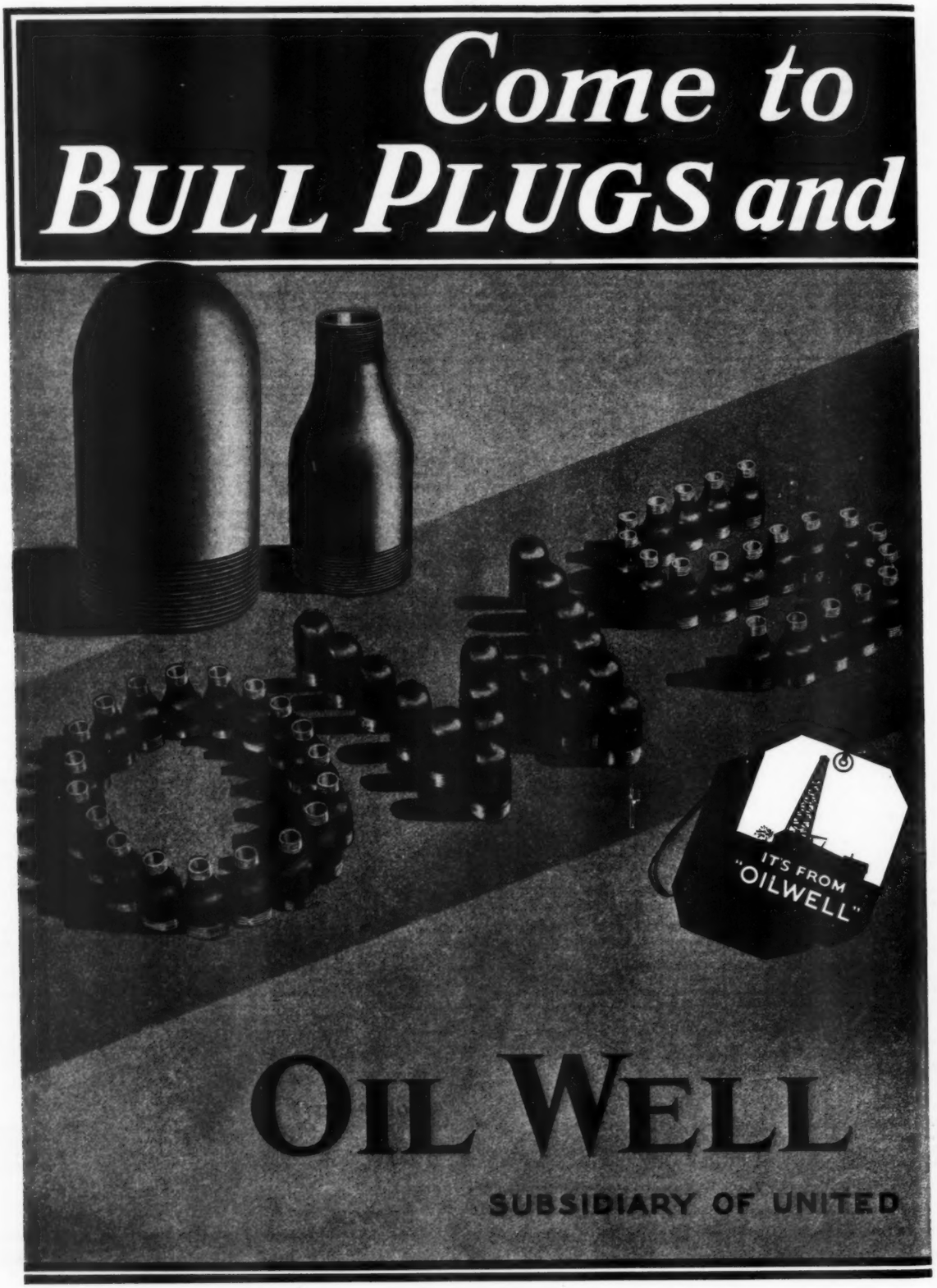
[2]Raven Oil & Refining Co.: J. M. McCreary, assistant refinery superintendent.

GEORGIA

Atlantic Refining Co.,	Brunswick	5,000	Comp.	3,600	Lewis	M. J. Welsh	W. Samans	R. D. Leonard	W. D. Anderson
Mexican Pet. Corp. (Georgia)	Savannah	4,000	A	....		H. T. Hulin	A. M. McKean	C. F. Hatmaker	C. F. Hatmaker

ILLINOIS

Henry H. Cross Co.	Joliet	2,500	S	....		J. A. Wood			
Henry H. Cross Co.	Dupo	1,000	S	....		J. L. McAndrew			
Globe Oil & Ref. Co.	Lemont	5,000	S-C	3,000	Winkler-Koch	D. B. Kelley		A. E. Landsittel	A. E. Landsittel
Indian Refining Co.	Lawrenceville	16,000	S-C-L	9,000	Cross & Dubbs	P. Wells			
Lincoln Oil Ref. Co.	Robinson	10,000	Comp.	7,600	Holmes-Manley	R. E. Luton	H. E. Handy	O. P. Epler	O. P. Epler
Lubrite Ref. Corp.	East St. Louis	3,500	S-C	3,000	Pratt Vapor Phase	C. P. Bettman	R. A. Frevert	E. Whatley	Edward R. Sneed
Red River Ref. Co.	Burnham	1,000	L	....		C. A. Harris	R. S. Watt	E. F. Buchanan	E. F. Buchanan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STATES STEEL CORPORATION

Survey of Operating Refineries in United States

Personnel and Plant Data

ILLINOIS (Continued)

Name and general offices—	President	Vice President	Secretary	Treasurer	Purchasing agent
Shell Petroleum Corp., Shell Bldg., St. Louis, Mo.[3]	U. deB Daly	T. F. Lydon*	P. R. Chenoweth	T. F. Lydon	C. B. Singleton
Standard Oil Co. (Indiana), 910 S. Michigan Ave., Chicago[1]	See Indiana	See Indiana	See Indiana	See Indiana	See Indiana
The Texas Company, Houston, Tex.	See Texas	See Texas	See Texas	See Texas	See Texas
White Star Refining Co. of Delaware, 903 W. Grand Blvd., Detroit, Mich.[4]	H. B. Earhart	H. A. Coffin	C. B. McCollough	W. V. Butler	H. M. Sullivan

*General manager.

[1]Indian Refining Co.: F. T. Manley, W. S. S. Rodgers, S. B. Wright, vice presidents; George W. Uzzell, assistant refinery superintendent; N. T. Stover, director of sales. Officers were elected January 23, 1931.

[2]Lincoln Oil Refining Co.: C. L. Fleming, vice president; T. W. Culmer, chief chemist; [2]Lubrite Refining Corp.: D. A. Windsor, refinery manager; L. T. Doiron, chief chemist. Abandoned Fleming cracking stills, November, 1930.

[4]Red River Refining Co.: John E. Schulze, chief technologist.

INDIANA

Bartles-Maguire Oil Co., 907 S. First St., Milwaukee, Wis.[1]	A. G. Maguire	Henry J. Stolz*	R. W. Fritzke	R. W. Fritzke	H. A. Steffen
Empire Oil & Refining Co., Bartlesville, Okla., and Beacon Life Bldg., Tulsa, Okla.[2]	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma
Shell Petroleum Corp., Shell Bldg., St. Louis Mo.[3]	See Illinois	See Illinois	See Illinois	See Illinois	See Illinois
Sinclair Refining Co., 45 Nassau St., New York, N. Y.[4]	E. W. Sinclair	J. W. Carnes	A. Steinmetz	J. Fletcher Farrell	H. B. Malone
Standard Oil Co. of Indiana, 910 S. Michigan Ave., Chicago, Ill.[5]	Edward G. Seubert	R. E. Humphreys	F. T. Graham	C. J. Barkdull	E. J. Bullock

*General manager.

[1]Bartles-Maguire Oil Co.: W. W. Reed, chief chemist.

[2]Empire Oil & Refining Co.: H. W. Camp, general refineries superintendent; see footnotes under Oklahoma.

[3]Shell Petroleum Corp.: All footnotes under Illinois.

[4]Sinclair Refining Co.: H. F. Sinclair, chairman of the board; Sheldon Clark, W. T. Dunkins, J. F. Farrell, M. L. Gosney, E. W. Isom, W. L. MacGready, J. M. O'Day, A. E.

KANSAS

Barnsdall Refineries, Inc., Petroleum Bldg., Tulsa, Okla.	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma
Derby Oil Co., 352 N. Lawrence Ave., Wichita[1]	A. L. Derby*	E. C. Moriarity	E. Wasser	E. C. Claiborne	R. E. Cowan
Eldorado Refining Co., Box 551, Eldorado[2]	Charles G. Yankey	Robert H. Hazlett	T. A. Helling*	Robert H. Bradford	O. G. Jackson
Golden Rule Refining Co., 120 W. First St., Wichita[3]	Elbert S. Rule*		W. C. Long	W. C. Long	W. C. Long
Phillips Petroleum Co., Bartlesville and Tulsa, Okla.	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma
Kanotex Refining Co., East Tyler Ave., Arkansas City[4]	C. M. Boggs	W. L. Lesh	E. K. Childers	R. R. Cox	H. A. Schramm
National Refining Co., 1404 E. Ninth St., Cleveland, Ohio[5]	Frank B. Fretter	C. S. Smith	J. D. Sadler	H. F. Heil	S. A. White
Peerless Oil & Refining Co., Chanute	Purchased by Lloyd D. Burton.				
Shell Petroleum Corp., Shell Bldg., St. Louis, Mo.	See Illinois	See Illinois	See Illinois	See Illinois	See Illinois
Sinclair Refining Co., 45 Nassau St., New York, N. Y.	See Indiana	See Indiana	See Indiana	See Indiana	See Indiana
Sinclair Refining Co., 45 Nassau St., New York, N. Y.	See Indiana	See Indiana	See Indiana	See Indiana	See Indiana
Skelly Oil Co. of Kansas, Skelly Bldg., Tulsa, Okla.[6]	W. G. Skelly*	C. C. Herndon	F. T. Hopp	F. T. Hopp	F. W. Robertson
Standard Oil Co. of Kansas, Neodesha[7]	A. S. Hopkins*	E. A. Warren	A. L. Morrison	A. L. Morrison	W. H. Hill
Vickers Petroleum Co. of Delaware, Wichita	J. A. Vickers	C. L. Henderson*	J. S. Wertz	J. S. Wertz	H. G. Shaw
White Eagle Oil Corp., 1400 Federal Reserve Bldg., Kansas City, Mo.[8]	R. R. Irwin	E. A. Kermott	L. E. Hanson	E. A. Kermott	W. C. Etzbach

*General manager.

[1]Derby Oil Co.: R. E. Wilsey, vice president; Charles Black, assistant refinery superintendent; Eldon Harris, chief chemist.

[2]Eldorado Refining Co.: C. M. Boone, chief chemist; H. J. Datin, assistant refinery superintendent.

[3]Golden Rule Refining Co.: Dr. O. B. van Fossen, chief chemist.

[4]Kanotex Refining Co.: Guy S. Kirk, chief chemist.

KENTUCKY

Aetna Oil Service, Inc., 1202 S. Third St., Louisville	Martin J. Quinn	Curtis C. Webb*	Frank Bailey	Frank Bailey	Frank Bailey
Ashland Refining Co., Inc., Ashland[1]	Thomas A. Combs	Paul G. Blazer*	E. L. McDonald	R. W. Grossenbach	R. W. Grossenbach
Glasgow Oil & Refining Co., Glasgow	R. B. Tyler	T. C. Dickinson	Sewell C. Harlin*	Sewell C. Harlin	Sewell C. Harlin
Latonia Refining Corp., East Ohio Gas Bldg., Cleveland, Ohio[2]	See Ohio	See Ohio	See Ohio	See Ohio	See Ohio
Louisville Refining Co., Inc., U. S. Trust Bldg., Louisville[3]	W. S. Dudley	J. Fred Miles*	H. R. Smith	H. R. Smith	C. A. Jouett
Standard Oil Co. of Kentucky, Louisville	W. E. Smith	J. C. Steidle	J. O. McGoodwin	J. C. Steidle	J. W. Bell
Stoll Oil Refining Co., 227 W. Main St., Louisville[4]	C. C. Stoll	George Stoll	William A. Stoll	William A. Stoll	
The Texas Company, Houston, Texas	See Texas	See Texas	See Texas	See Texas	See Texas

*General manager.

[1]Ashland Refining Co.: T. A. Field, vice president; D. H. Jenks, Jr., chief chemist.

[2]Latonia Refining Corp.: Operated by the Standard Oil Co. of Ohio as a 100 per cent owned subsidiary; Montague Ball, assistant refinery superintendent at Latonia.

LOUISIANA

Bayou State Refining Corp., 1008 Slattery Bldg., Shreveport[1]	Frank M. Cook	Sidney M. Cook	J. F. Knox	Frank M. Cook	J. F. Knox
Chalmette Petroleum Corp., Union Indemnity Bldg., N. Orleans[2]	W. E. Winship*	B. C. McClellan	R. P. Batson	William Leftwich	V. G. McPherson
Dartois Oil Refinery, 816 Slattery Bldg., Shreveport	Not incorporated		J. E. Slattery*	J. E. Slattery	Peter J. Dartois
Louisiana Oil Refining Corp., P. O. Box 1117, Shreveport[3]	H. L. Doherty	M. J. Grogan	C. R. Harrison	T. H. Grobe	F. T. Reed
Mexican Petroleum Corp. of La., Inc., 122 E. 42nd St., New York[4]	R. G. Stewart	P. H. Harwood	A. N. Penn	L. W. Bernhard	H. A. Harley
Shell Petroleum Corp., Shell Bldg., St. Louis, Mo.[5]	See Illinois	See Illinois	See Illinois	See Illinois	See Illinois
Shreveport Eldorado Pipe Line Co., Inc., 1411 Slattery Bldg., Shreveport[6]	William Lilley	J. B. Atkins	J. F. Atkins	B. H. Gray	M. W. Bass
Standard Oil Co. of Louisiana, Baton Rouge[7]	D. R. Weller	A. K. Gordon	J. A. Bechtold	A. K. Gordon	W. N. Cottrell
Stanolind Oil & Gas Co., Philcade Bldg., Tulsa, Okla.	F. O. Prior*	A. M. McCorkle	A. M. McCorkle	A. M. McCorkle	R. B. Rice
The Texas Company, Houston, Texas	See Texas	See Texas	See Texas	See Texas	See Texas

*General manager.

[1]Bayou State Refining Co.: G. S. Knox, assistant refinery superintendent.

[2]Chalmette Petroleum Corp.: Chester Dubus, assistant refinery superintendent; Aaron Abramson, chief chemist.

[3]Louisiana Oil Refining Corp.: D. W. Harris, B. P. Crittenden, vice presidents; J. A. O'Neill, assistant refinery superintendent; A. W. Trusty, chief chemist.

[4]Mexican Petroleum Corp. of Louisiana: T. S. Cooke, vice president and general manager in charge of manufacturing.

MARYLAND

Continental Oil Co. (Delaware), Ponca City, Okla.	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma
Mexican Petroleum Corp., 122 E. 42nd St., New York	See Louisiana	See Louisiana	See Louisiana	See Louisiana	See Louisiana
Standard Oil Co. of New Jersey, 26 Broadway, New York[1]	See New Jersey	See New Jersey	See New Jersey	See New Jersey	See New Jersey

[1]Standard Oil Co.: E. A. Rudigier, general manager of Baltimore, Charleston, S. C., and Parkersburg W. Va., refineries.

MASSACHUSETTS

Colonial Beacon Oil Co., Inc., Everett[1]	A. Clarke Bedford	E. N. Wrightington	L. J. Walsh	H. W. Boutilier	E. N. Wrightington
Cities Service Refining Co., 260 Tremont St., Boston[2]	H. L. Doherty	H. Frueauff	J. V. Koons	L. F. Musil	C. L. Boyle

[1]Colonial Beacon Oil Co.: L. J. Walsh, H. H. Hewetson, vice presidents; W. W. Peters, chief chemist; F. F. Hale, general sales manager.

[2]Cities Service Refining Co.: W. A. Jones, vice president; J. S. Cordell, vice president and general manager; L. M. Bound, general superintendent; W. W. Scheumann, chief chemist.

MICHIGAN

Henry H. Cross Co., 936 Peoples Gas Bldg., Chicago	See Arkansas	See Arkansas	See Arkansas	See Arkansas	See Arkansas
Naph-Sol Refining Co., Muskegon, Mich.	W. E. Anderson*	J. H. Helms	A. W. Penney	A. W. Penney	
Old Dutch Refining Co., Box 442, Muskegon[1]	Walter E. Anderson	E. L. Hughes	John Borden	John Borden	
Roosevelt Oil Co., 360 N. Michigan Ave., Chicago, Ill.	C. L. Maguire	T. F. Caldwell*	M. E. Sheridan	T. F. Caldwell	
White Star Refining Co., 903 W. Grand Blvd., Detroit[2]	H. B. Earhart	H. A. Coffin	C. B. McCollough	M. V. Butler	H. M. Sullivan

[1]Old Dutch Refining Co.: Walter Schuttler, chairman of the board; R. A. Cronwell, chief chemist.

[2]White Star Refining Co.: L. R. Hunter, J. B. Edwards, vice presidents; H. C. Smith, assistant refinery superintendent; Dr. E. E. Potthoff, chief chemist.

Survey of Operating Refineries in United States

Personnel and Plant Data

ILLINOIS (Continued)

Name of company—	Plant location	Daily crude capacity	Type plant	Daily crack. capacity	Type cracking unit	Plant superintendent	Chief engineer	Sales Managers— Tank car	Sales Managers— Bulk and service station
Shell Pet. Corp.	Wood River	46,000	L-C	20,500	Cross & Dubbs	E. H. Schippers		L. van Eeghen	L. van Eeghen
Standard Oil Co. (Ind.)	Wood River	30,000	Comp.	30,000	Burton & Holmes-Manley	S. A. Montgomery	See Indiana	See Indiana	See Indiana
The Texas Company	Lockport	20,000	Comp.	9,000	Holmes-Manley	G. B. Bogart	See Texas	See Texas	See Texas
White Star Ref. Co.	Wood River	5,500	S-C	3,100	Dubbs	S. G. Keller		C. B. McCollough	L. R. Hunter

[5]Shell Petroleum Corp.: Dr. W. H. van Holst Pellekaan, Alexander Fraser, Dr. F. W. Tydeman, in charge of manufacturing, G. S. Rollin, vice presidents; S. Tijmstra, chief chemist; assistant refinery superintendents: Wood River, H. A. Stiles; East Chicago, J. L. Miller; Arkansas City, P. E. Hurley; Houston, T. G. Elder.

[6]White Star Refining Co.: L. R. Hunter, J. B. Edwards, vice presidents; W. W. Hammack, assistant refinery superintendent; Dr. E. H. Potthoff, chief chemist.

[7]Standard Oil Co. (Indiana): C. B. Manbeck is manager of the Wood River refinery, and F. J. Gainer is assistant superintendent. See other footnotes under Indiana.

INDIANA

Bartles-Maguire Oil Co.	East Chicago	5,000	C	5,000	Jenkins, Vapor Phase	William Hildebrandt		H. J. Dolan	M. G. Peeters
Empire Oil & Refining Co.	East Chicago	25,000	S-C	15,000	Doherty	E. H. Roy	Clay Briggs	See Oklahoma	See Oklahoma
Shell Petroleum Corp.	East Chicago	27,000	S-A	10,000	Dubbs	Dr. R. H. Waser	S. Petersen	L. van Eeghen	J. A. Strong
Sinclair Refining Co.	East Chicago	40,000	S-L-C	35,000	Isom, Sinclair	R. J. Black		See footnotes	See footnotes
Standard Oil Co. of Indiana	Whiting	90,000	C-L-A-W	56,000	Burton, Cross, Holmes-Manley	H. F. Glair		Allan Jackson	Allan Jackson

Watts, G. T. Sanford, R. W. Ragland, L. V. Stanford, George H. Taber, Jr., vice presidents; George H. Taber, Jr., in charge of manufacturing.

[5]Standard Oil Co. of Indiana: See Note 1 under Colorado. Standard (Indiana) also owns Burton Process used at Casper, Wyo., plant of Midwest Refining Co. R. H. McElroy, Allan Jackson, C. J. Barkdull, E. J. Bullock, vice presidents; Gentry Cash, general manager in charge of manufacturing; Allan Jackson, general manager in charge of sales.

KANSAS

Barnsdall Refineries, Inc.	Wichita	4,000	S-C	1,500	Dubbs	F. S. Horne		See Oklahoma	See Oklahoma
Derby Oil Co.	Wichita	8,000	S-C	3,000	Dubbs	F. W. McCurry	A. B. Hungerford	C. A. Keller	E. A. Hawthorne
Eldorado Refining Co.	Eldorado	5,000	S-C	2,000	Winkler-Koch	G. C. Anderson		C. W. Rice	
Golden Rule Refining Co.	Wichita	1,000	S-C	1,200	Jenkins	J. H. McIntyre		W. C. Long	W. C. Long
Phillips Pet. Co.	Kansas City	5,000	S-C	2,000	Dubbs	J. W. Mitchell		See Oklahoma	See Oklahoma
Kanotex Refining Co.	Arkansas City	15,000	S-C	5,000	Jenkins, Donnelly	F. A. Deering	E. R. Trask	W. L. Lesh	
National Refining Co.	Coffeyville	6,500	S-L	....		H. B. Setzler			
Peerless Oil & Ref. Co.	Chanute	2,500	S-C	2,000	Jenkins	Reuben Werlin			
Shell Pet. Corp.	Arkansas City	20,000	S-C	9,000	Dubbs	See Indiana	See Indiana	See Indiana	See Indiana
Sinclair Refining Co.	Kansas City	11,000	S-C	10,000	Isom	B. J. Healy			
Sinclair Refining Co.	Coffeyville	12,000	Comp.	10,000	Isom	George Beddington	See Indiana	See Indiana	See Indiana
Skelly Oil Co.	Eldorado	18,000	C-L-S	18,000	Skelly	K. J. Smith	J. J. Shea	W. T. Atkins	W. T. Atkins
Standard Oil Co. of Kansas	Neodesha	20,000	S-C-A	15,000	Holmes-Manley & Burton	E. A. Metcalf	A. M. Burton	E. A. Warren	E. A. Warren
Vickers Pet. Co.	Potwin	3,500	S-C	1,500	Dubbs	A. M. Shrepfer		Myers Gross	Myers Gross
White Eagle Oil Corp.	Augusta	10,000	S-A-C	8,000	Coil	C. C. Durkee		H. L. McReynolds	C. L. Jolliffe

[5]National Refining Co.: W. H. Lamprecht, H. F. Heil, vice presidents.

[6]Skelly Oil Co.: H. M. Stalcup, R. T. Lyons, vice presidents; Emby Kaye, Tulsa, in charge of manufacturing department; H. V. S. Smith, assistant refinery superintendent; E. A. Todd, chief chemist.

[7]Standard Oil Co. of Kansas: E. A. Bailey, assistant refinery superintendent; L. J. Catlin, chief chemist.

[8]White Eagle Oil Corp.: R. D. Mering, James P. Kem, vice presidents.

KENTUCKY

Aetna Oil Service, Inc.	Louisville	2,000	S-C	400	Fleming	A. T. Judy	A. T. Judy	Frank Bailey	Frank Bailey
Ashland Refining Co.	Leach	4,000	S-C	1,000	Dubbs	Fred W. Irwin	Fred W. Irwin	Everett F. Wells	A. A. Hines
Glasgow Oil & Refining Co.	Glasgow	250	S	....					J. R. Richey
Latonia Refining Corp.	Latonia	8,000	S-C	4,500	Tube and Tank	E. A. Brown	See Ohio	See Ohio	See Ohio
Louisville Refining Co.	Louisville	4,000	S-C	2,000	Dubbs	C. A. Jouett	E. S. Handley	H. R. Smith	
Standard Oil Co. of Kentucky	Louisville	5,000	S-C	3,000	Burton	A. K. Whitelaw	W. E. Smith	W. G. Violette	
Stoll Oil Refining Co.	Louisville	1,500	S-L-C	700	Berry V. Stoll	John W. Kittner	C. Arterburn	George Stoll	Charles E. Stoll
The Texas Company	Pryse	2,000	S-C-L	2,000	Holmes-Manley	J. R. Reed	See Texas	See Texas	See Texas

[3]Louisville Refining Co.; Eli H. Brown, Jr., vice president; G. C. Hatfield, assistant refinery superintendent; J. R. Curry, chief chemist.

[4]Stoll Oil Refining Co.: Berry V. Stoll, Charles E. Stoll, vice presidents; George Kittner, assistant refinery superintendent; Clem S. Luce, chief chemist.

LOUISIANA

Bayou State Refining Co.	Hosston	750	L	....		J. F. Knox	T. N. Reed	Frank M. Cook	
Chalmette Petroleum Corp.	Chalmette	5,000	S	1,800	Winkler-Koch	J. V. Gaudet	J. V. Gaudet	Louis Abramson, Jr.	Louis Abramson, Jr.
Dartois Oil Refinery	Shreveport	80	S-L	....		Peter J. Dartois	Peter J. Dartois	Either partner	Either partner
Louisiana Oil Refining Corp.	Gas Center	19,000	S	13,000	Tube &Tank; Ellis	R. B. Pierce	E. R. Smith	C. M. Lamason	W. S. Waters
Mexican Petroleum Corp.	Destrehan	20,000	S-A	....		F. W. Grey	A. M. McKean	C. F. Hatmaker	C. F. Hatmaker
Shell Petroleum Corp.	Norco	15,000	S-C	10,000	Dubbs	W. G. Horstman	See Illinois	See Illinois	See Illinois
Shreveport Eldorado Co.	Shreveport	10,000	S-C	3,000	Dubbs; Jenkins	D. H. Christman			
Standard Oil Co. of Louisiana	Baton Rouge	100,000	Comp.	65,000	Cross; Link; Tube and Tank	L. Link	W. A. Gotschall	T. H. Taylor	J. V. Gresham
Stanolind Oil & Gas Co.	Superior	5,000	S-C	2,000	Cross	O. W. White		A. M. McCorkle	A. M. McCorkle
The Texas Company	Shreveport	6,500	S	....		R. H. Donaldson		See Texas	See Texas

[5]Shell Petroleum Corp.: P. E. Foster, assistant refinery superintendent.

[6]Shreveport Eldorado Pipe Line Co.: B. H. Gray, vice president; J. K. McKinnon, assistant refinery superintendent; H. O. Sivess, chief chemist.

[7]Standard Oil Co. of Louisiana: C. O. Scholder, C. I. Fiero, J. A. Bechtold, A. Clark Bedford, vice presidents; F. C. Read, chief chemist.

MARYLAND

Continental Oil Co.	Baltimore	10,000	S-C	2,400	Dubbs	J. W. Brown	See Oklahoma	See Oklahoma	See Oklahoma
Mexican Petroleum Corp.	Baltimore	8,000	S-A	....		W. W. Hulin	A. M . McKean	See Louisiana	See Louisiana
Standard Oil Co. of N. J.	Baltimore	32,000	Comp.	43,597	Tube and Tank	J. F. Ewing	See New Jersey	See New Jersey	See New Jersey

MASSACHUSETTS

Colonial Beacon Oil Co.	Everett	28,000	S-C-A	22,000	Tube and Tank	D. L. Ferguson	H. L. Bolton	J. C. Richdale	F. R. Powers
Cities Service Refining Co.	East Braintree	15,000	S-L-C	6,300	Doherty; Holmes-Manley	D. P. Sturges	H. A. Mott	J. A. Kelley	T. J. Spellman

MICHIGAN

Henry H. Cross Co.	Muskegon	1,000	S	....		W. W. Smedley		See Arkansas	See Arkansas
Naph-Sol Refining Co.	Muskegon	1,500	S	....		J. H. Helms		Alex V. Smith	Alex V. Smith
Old Dutch Refining Co.	Muskegon	3,000	S	....		E. G. Guy		E. L. Hughes	
Roosevelt Oil Co.	Mt. Pleasant	2,500	S	....		E. G. Guy		T. F. Caldwell	T. F. Caldwell
White Star Refining Co.	Trenton	6,600	S-C	3,900	Dubbs	A. F. Zoll		C. B. McCollough	L. R. Hunter

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Omaha
Oklahoma City
Tulsa

A Unit of the Standard Gas and Electric System

Survey of Operating Refineries in United States

Personnel and Plant Data

MISSOURI

Name and general offices—	President	Vice President	Secretary	Treasurer	Purchasing agent
Joplin Refining Co., Box 866, Joplin	A. E. Basinger*		W. F. Maher	W. F. Maher	C. S. Banks
Standard Oil Co. of Indiana, 910 Michigan Ave., Chicago, Ill.	See Indiana	See Indiana	See Indiana	See Indiana	See Indiana

*General manager.

MONTANA†

Arro Oil & Refining Co., Lewistown	H. H. Schwartz	Edward L. Allen*	Guy R. Enlow	Edward L. Allen	Edward L. Allen
Boris A. S. Aronow, Box 391, Shelby[1]	Boris A. S. Aronow*	(owner)			
Boris A. S. Aronow, Box 391, Shelby	See above				
Associated Gas & Oil Co., Anaconda Highway, Butte[1]	Kenneth Christie	J. Bruce Kremer	Alfred C. Torgerson	Alfred C. Torgerson	
Highorn Oil & Refining Co., E. Fourth Ave., Billings[2]	D. D. Gibson*	Paul Stock	J. G. Everett	J. G. Everett	D.D.Gibson-J.G.Everett
Big West Oil Co., 615 Hutton Bldg., Spokane, Wash.[3]	L. R. Hawley	H. L. Bargion	John E. Orr	L. R. Hawley	L. R. Hawley
Conrad Refining Co., Conrad	Perry L. Withers*	J. F. Kumpf	William F. Gast	William F. Gast	Perry L. Withers
Continental Oil Co., Ponca City, Okla.	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma
Hart Refineries, Missoula	C. W. Hart*		E. G. Hart	E. G. Hart	
Hart Refineries, Missoula	See above		See above	See above	
Laurel Oil & Refining Co., Guaranty Trust Bldg., Portland, Ore.[4]	Alfred J. Diescher	William P. Lipman	Roscoe C. Nelson	Roscoe C. Nelson	
Northwest Stellarene Co., Inc., Shelby, Mont.; Mount Vernon, Ohio, and New York, N. Y.[5]	W. G. Leamon	James W. Johnson	F. E. Cannon	F. E. Cannon	P. R. MacHale
Russell Oil Co., 642 Utah Ave., Butte	Joseph Russell*		A. Russell	Joseph Russell	
Russell Oil Co., 642 Utah Ave., Butte	See above		See above	See above	
Snow Cap Oil Co., Sunburst	Adam J. Eulberg*	Edward F. Eulberg	Benjamin A. Eulberg	Benjamin A. Eulberg	
Sunburst Oil & Refining Co., Great Falls	L. C. Stevenson*	G. C. Stevenson	E. B. Scoville	J. H. Stevenson	C. E. Anderson
The Texas Company, Houston, Tex.	See Texas	See Texas	See Texas	See Texas	See Texas
Toole County Refining Co., Oilmont	F. E. Peterson		J. A. Coons*	J. A. Coons	
Yale Oil Corp. of South Dakota, Miles City[6]	L. B. Hancock	P. N. Fortin*	P. N. Fortin	L. B. Hancock	P. N. Fortin
Yale Oil Corp. of South Dakota, Miles City	See above	See above	See above	See above	See above

*General manager.
†Several refineries in Montana do not operate during the winter months.
[1]Associated Gas & Oil Co.: Douglas Lewis, chief chemist.
[2]Highorn Oil & Refining Co.: J. E. Simon, chief chemist.
[3]Big West Oil Co.: Charles P. Lund, vice president.

NEW MEXICO

Continental Oil Co., Ponca City, Okla.	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma
Continental Oil Co., Ponca City, Okla.	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma
Continental Oil Co., Ponca City, Okla.	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma
Valley Refining Co., Box 660, Roswell	J. F. Campion*	S. W. Lodewick	S. P. Johnson, Jr.	S. P. Johnson, Jr.	

*General manager.

NEW JERSEY

Barber Asphalt Co., 1,600 Arch St., Philadelphia, Pa.[1]	Arthur W. Sewall	Charles W. Bayliss	E. R. Riter	Frank J. Robertson	
Crew-Levick Co., 400 N. Broad St., Philadelphia, Pa.[2]	See Pennsylvania	See Pennsylvania	See Pennsylvania	See Pennsylvania	See Pennsylvania
Gulf Refining Co., Frick Annex Bldg., Pittsburgh, Pa.	See Pennsylvania	See Pennsylvania	See Pennsylvania	See Pennsylvania	See Pennsylvania
Standard Oil Co. of New Jersey, 26 Broadway, New York, N. Y.[3]	Charles G. Black	George W. McKnight	Charles T. White	R. P. Resor	
Standard Oil Co. of New Jersey, 26 Broadway, New York, N. Y.	See above	See above	See above	See above	See above
Standard Oil Co. of New Jersey, 26 Broadway, New York, N. Y.	See above	See above	See above	See above	See above
Tide Water Oil Co., 17 Battery Place, New York, N. Y.[4]	Axtell J. Byles	E. L. Shea	F. I. Fallon	K. R. Hankinson	C. H. Bickell
Vacuum Oil Co., 61 Broadway, New York, N. Y.[5]	C. E. Arnott	C. E. Bedford	G. V. Holton	Herbert Baker	J. R. Taylor
Warner-Quinlan Co., 2 Park Ave., New York, N. Y.[6]	W. W. McFarland	Frank Frankel	George Frankel	George Frankel	Samuel Secular

[1]Barber Asphalt Co.: Frank Seamans, vice president; John H. Weller, general manager; Joseph Slutzker, refinery manager; J. S. Miller, chief chemist; Louis, Schieck, assistant refinery superintendent.
[2]Crew-Levick Co.: J. W. Griswold, manager of refineries; A. P. Frame, assistant refinery superintendent.
[3]Standard Oil Co. of New Jersey: C. G. Sheffield, Richardson Pratt, vice presidents.

NEW YORK

Sinclair Refining Co., 45 Nassau St., New York, N. Y.	See Indiana	See Indiana	See Indiana	See Indiana	See Indiana
Standard Oil Co. (New York), 26 Broadway, New York, N. Y.[1]	Charles F. Meyer	Howard E. Cole	William B. Walker	Richard P. Tinsley	R. W. Hamlet
Standard Oil Co. (New York), 26 Broadway, New York, N. Y.	See above	See above	See above	See above	See above
Vacuum Oil Co., 61 Broadway, New York, N. Y.	See New Jersey	See New Jersey	See New Jersey	See New Jersey	See New Jersey

[1]Standard Oil Co. of New York: Edwin R. Brown, Frederick S. Fales, Peter M. Speer, John A. Brown, Howard A. Wilkinson, vice presidents; W. F. Burt, general manager; W. J. Mooney, J. T. Palmer, J. C. Allen, assistant refinery superintendents at Brooklyn and Long Island City works; R. T. Lockwood, G. W. Armstrong, assistant refinery superintendents at

OHIO

Allegheny-Arrow Oil Co., Gambrinus Ave., Canton[1]	R. K. Shoolroy*	W. M. Thompson	W. M. Thompson	R. K. Shoolroy	R. K. Shoolroy
Canfield Oil Co., 3216 E. Fifty-fifth St., Cleveland[2]	Louis Carruth	Charles McLean	H. M. Carruth	J. A. Jackson	M. C. Dippel
Craig Oil Co., Weaver St. at Gleason, Toledo	Pressly I. Craig	J. F. Minke	George L. Craig, Jr.	Justin H. Bender	
National Refining Co., 1404 E. Ninth St., Cleveland[3]	Frank B. Fretter	C. S. Smith	J. D. Sadler	H. F. Heil	S. A. White
National Refining Co., 1404 E. Ninth St., Cleveland	See above	See above	See above	See above	See above
Gulf Refining Co., Frick Annex Bldg., Pittsburgh	See Pennsylvania	See Pennsylvania	See Pennsylvania	See Pennsylvania	See Pennsylvania
Gulf Refining Co., Frick Annex Bldg., Pittsburgh[3]	See Pennsylvania	See Pennsylvania	See Pennsylvania	See Pennsylvania	See Pennsylvania
Pure Oil Co., 35 E. Wacker Drive, Chicago, Ill.[4]	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma
Pure Oil Co., 35 E. Wacker Drive, Chicago, Ill.	See above	See above	See above	See above	See above
Solar Refining Co., Box 581, Lima[5]	F. T. Cuthbert	J. R. Cuthbert*	H. A. Graham	H. A. Graham	F. W. Engle
Standard Oil Co. of Ohio, Midland Bldg., Cleveland[6]	W. T. Holliday*	Howard G. Jones	F. H. Kelly	Howard G. Jones	C. A. Sherwood
Standard Oil Co. of Ohio, Midland Bldg., Cleveland	See above	See above	See above	See above	See above
Stellar Refining Co., Marne[7]	W. G. Leamon	J. W. Leonard	D. R. Buchanan	D. R. Buchanan	M. V. Buchanan
Sun Oil Co., Finance Bldg., Philadelphia, Pa.	See Pennsylvania	See Pennsylvania	See Pennsylvania	See Pennsylvania	See Pennsylvania
Superoil Co., Tiffen and Weaver Sts., Toledo	F. S. Jerome	R. R. Adams	C. L. Hopkins	T. E. Keen*	T. E. Keen

*General manager.
[1]Allegheny-Arrow Oil Co.: Edward Reiser, vice president; Reid Brazel, assistant refinery superintendent.
[2]Canfield Oil Co.: L. W. Hodous, chief chemist.
[3]National Refining Co.: W. H. Lamprecht, H. F. Heil, vice presidents.
[4]Pure Oil Co.: H. L. Smith, assistant refinery superintendent at Toledo plant.
[5]Solar Refining Co.: E. L. Hughes, vice president; Frank Hawkins, chief chemist.
[6]Standard Oil Co. of Ohio: A. M. Maxwell, vice president in charge of sales; J. S.

OKLAHOMA

Anderson-Prichard Oil Corp., Colcord Bldg., Oklahoma City[1]	L. H. Prichard	J. Steve Anderson	P. H. Anderson	P. H. Anderson	W. M. Sturges
Barnsdall Refineries, Inc., Petroleum Bldg., Tulsa[2]	E. B. Reeser	F. E. Holsten	James A. Dunn	H. M. Edinger	E. O. McClatchey
Barnsdall Refineries, Inc., Petroleum Bldg., Tulsa	See above	See above	See above	See above	See above
Bell Oil & Gas Co., Tulsa	Samuel L. Lubell	Mark Finston*	Albert Finston	Jacob J. Lubell	Rex Young
Black Gold Refining Co., Oklahoma City	Dan A. Corcoran*	Charles W. Scott		Dan A. Corcoran	
Capital Producing & Refining Co., Oklahoma City[3]	J. R. Travis*	I. M. Roddie	Ed C. Tippett	Ed C. Tippett	A. R. Stribling
Century Petroleum Co., 401 Petroleum Bldg., Oklahoma City[4]	Roy S. Randerson	Matthew Nelson	L. B. Randerson	Roy S. Randerson	Frank Blackwood
Century Petroleum Co., 401 Petroleum Bldg., Oklahoma City	See above	See above	See above	See above	See above
Champlin Refining Co., Enid[5]	H. H. Champlin*	Fred C. Champlin	D. W. Cotton	D. W. Cotton	L. E. Noble
Continental Oil Co., Ponca City[6]	D. J. Moran*	Walter Miller	W. W. Bruce	G. F. Smith	W. H. O'Connor
Continental Oil Co., Ponca City	See above	See above	See above	See above	See above
Crump Refining Co., 2300 E. Reno, Oklahoma City[7]	Don Crump*	Don Mawhead	W. L. Beaver	W. L. Beaver	
Cushing Refining & Gasoline Co., Box 728, Cushing	E. C. Mullendore	E. J. Black	Rex H. Winget*	R. C. Jones	Rex H. Winget
Cushing Refining & Gasoline Co., Box 728, Cushing	See above	See above	See above	See above	See above
Deep Rock Oil Corp., Atlas Life Bldg., Tulsa[8]	John J. O'Brien	John L. Gray*	W. R. Francisco	W. R. Francisco	R. G. Martin

Survey of Operating Refineries in United States

Personnel and Plant Data

MISSOURI

Name of company—	Plant location	Daily crude capacity	Type plant	Daily crack. capacity	Type cracking unit	Plant superintendent	Chief engineer	Sales Managers— Tank car	Sales Managers— Bulk and service station
Joplin Refining Co.	Joplin	1,500	S-C	1,000	Jenkins	C. S. Banks		George Ogdon	George Ogdon
Standard Oil Co. of Indiana	Sugar Creek	20,000	S-C-L-A-W	15,000	Burton & Holmes-Manley	G. H. Moffett		See Indiana	See Indiana

MONTANA†

Arro Oil & Refining Co.	West Lewistown	1,500	S-C	600	Dubbs	Paul Jones		L. R. Gilmour	L. R. Gilmour
Boris A. S. Aronow	East Kalispell	1,000	S	....		John G. Noren			
Boris A. S. Aronow	West Havre	600	S	....		Elias Hauskins			
Associated Gas & Oil Co.	Butte	750	S	....		Douglas Lewis	A. W. Anderson	John O'Brien	John O'Brien
Bighorn Oil & Refining Co.	Billings	4,000	S	....		D. D. Gibson	Guy R. Morris	J. G. Everett	J. G. Everett
Big West Oil Co.	Kevin	1,200	S	....		Amed Soderstrom	George Engle	Amed Soderstrom	Amed Soderstrom
Conrad Refining Co.	Conrad	750	S	....		Philip W. Smith			
Continental Oil Co.	Lewistown	1,500	S	....		B. J. Manley		See Oklahoma	See Oklahoma
Hart Refineries	Missoula	400	C	400	Liquid phase	J. H. Lilly			
Hart Refineries	Hedgesville	100	S	....		G. A. Sorbo			
Laurel Oil & Refining Co.	Laurel	5,000	C	1,500	Donnelly			Frank T. Johnson	Frank T. Johnson
Northwest Stellarene Co., Inc.	Shelby	2,000	S	....		Ralph Vadness	Ralph M. Parsons	James W. Johnson	James W. Johnson
Russell Oil Co.	Butte	1,000	S	....		John Horn			
Russell Oil Co.	Billings	1,500	S	....		A. Kolsted			
Snow Cap Oil Co.	Sunburst	350	S	....		B. A. Eulberg	A. J. Eulberg		
Sunburst Oil & Refining Co.	Great Falls	3,000	S	....		C. E. Anderson	C. E. Anderson	B. G. Stevenson	B. G. Stevenson
The Texas Company	Sunburst	4,500	S-C	3,000	DeFlorez	T. J. Landry	See Texas	See Texas	See Texas
Toole County Refining Co.	Oilmont	300	S	....					
Yale Oil Corp.	Billings	2,000	S	....		R. D. Kenyon		P. N. Fortin	W. P. McCracken
Yale Oil Corp.	Miles City	800	S	....		A. A. Whittier		See above	See above

[4]Laurel Oil & Refining Co.: W. A. Manion, general manager.
[5]Northwest Stellarene Co., Inc.: R. J. Lindsay, vice president; W. G. Eley, chief chemist.
[6]Yale Oil Corp. of South Dakota: A. A. Whittier, chief chemist.
[7]Boris A. S. Aronow: Installing cracking unit.

NEW MEXICO

Continental Oil Co.	Farmington	1,000	S	....		H. H. Kinnaird	See Oklahoma	See Oklahoma	See Oklahoma
Continental Oil Co.	Artesia	1,500	S	....		Charles Morgan	See Oklahoma	See Oklahoma	See Oklahoma
Continental Oil Co.	Albuquerque	1,000	S	....		E. L. Rogers	See Oklahoma	See Oklahoma	See Oklahoma
Valley Refining Co.	Roswell	500	S	....		E. A. Whaline		J. F. Campion	J. F. Campion

NEW JERSEY

Barber Asphalt Co.	Maurer	10,000	S-A	2,000	Cross	H. J. Fleisher	C. T. McGrady	H. C. Hottel	H. C. Hottel
Crew-Levick Co.	Pettys Island	5,000	S	....		E. M. Keely	See Pennsylvania	See Pennsylvania	See Pennsylvania
Gulf Refining Co.	Bayonne	30,000	S-C	1,000	De Florez	H. V. Sanderson	See Pennsylvania	See Pennsylvania	See Pennsylvania
Standard Oil of New Jersey	Bayonne	88,000	Comp.	45,000	Modified Tank & Tube	F. W. Abrams		C. G. Sheffield	C. G. Sheffield
Standard Oil of New Jersey	Jersey City	17,000	L	....		F. W. Abrams		See above	See above
Standard Oil of New Jersey	Linden	75,000	Comp.	113,837	Tube & Tank	F. W. Abrams		See above	See above
Tide Water Oil Co.	Bayonne	50,000	Comp.	10,700	Tube & Tank	J. J. McGrath	E. Eilsberg	L. C. Quackenbush	J. D. Collins
Vacuum Oil Co.	Paulsboro	20,000	Comp.	9,000	Cross, Ellis	H. F. Abrams	H. F. Abrams	J. R. Taylor	J. R. Taylor
Warner-Quinlan Co.	Warners	18,000	S-C	1,500	Dubbs	J. K. Giles	R. B. Gove	B. Frankel	B. Frankel

F. W. Abrams is general manager of the New Jersey refineries.
[8]Tide Water Oil Co.: Noel Robinson, E. H. Salrin, vice presidents; R. D. Rogers, general manager of refinery; L. W. Parsons, chief chemist.
[9]Vacuum Oil Co.: Herbert Baker, chairman of the board; H. F. Abrams, manager of the manufacturing committee.
[10]Warner-Quinlan Co.: Morris Frankel, Loris Ravicz, vice presidents; Frank Kessler, chief chemist.

NEW YORK

Sinclair Refining Co.	Wellsville	10,000	Comp.	....		Otto Walchli	See Indiana	See Indiana	See Indiana
Standard Oil Co. of New York	New York	19,000	Comp.	8,000	Cross	R. B. Malone and F. W. Hadley	C. A. Ellis	H. A. Wilkinson	H. A. Wilkinson
Standard Oil Co. of New York	Buffalo	5,000	Comp.	2,000	Cross	See above	See above	See above	See above
Vacuum Oil Co.	Olean	6,500	Comp.-C	3,000	See notes	See New Jersey	See New Jersey	See New Jersey	See New Jersey

Buffalo refinery; Dr. J. B. Rather, chief chemist.

OHIO

Allegheny-Arrow Oil Co.	Canton	1,200	S-C	800	Dubbs	M. S. Beringer		Edward Reiser	Edward Reiser
Canfield Oil Co.	Cleveland	1,000	L	....		S. L. Milliff			M. C. Dippel
Craig Oil Co.	Toledo	1,500	S-L-W	....				John H. Van Dersluys	John H. Van Dersluys
National Refining Co.	Findlay	2,500	L	....		A. J. Rogers			
National Refining Co.	Marietta	750	L	....		Fred Bergen			
Gulf Refining Co.	Toledo	12,000	S-C	6,000	Gulf	C. W. Luton		See Pennsylvania	See Pennsylvania
Gulf Refining Co.	Cincinnati	12,000	S-C	6,000	Gulf	Thomas J. Twomey		See above	See above
Pure Oil Co.	Toledo	8,000	S-C	3,600	Gyro	O. B. Wendeln	See Oklahoma	See Oklahoma	See Oklahoma
Pure Oil Co.	Heath	11,000	S-C	7,600	Cross, Gyro	E. E. McPherson	See Oklahoma	See Oklahoma	See Oklahoma
Solar Refining Co.	Lima	18,000	Comp.	6,000	Burton and Cross	J. M. Cory	S. M. Williams	E. L. Hughes	E. L. Hughes
Standard Oil Co. of Ohio	Cleveland	20,000	Comp.	8,000	Tube and Tank	L. S. Bale	J. S. Harrison	A. B. Nichols	A. A. Stambaugh
Standard Oil Co. of Ohio	Toledo	12,000	Comp.	4,000	Tube and Tank	G. W. Hanneken	See above	See above	See above
Stellar Refining Co.	Marne	1,000	S-C	250	Leamon	A. W. Goldsbarry	W. G. Leamon	W. V. Buchanan	W. V. Buchanan
Sun Oil Co.	Toledo	12,000	S-C	3,000	Various types	H. O. Cameron	See Pennsylvania	See Pennsylvania	See Pennsylvania
Superoil Co.	Toledo	250	L	....		J. J. Curran		T. E. Keen	T. E. Keen

Harrison, vice president in charge of manufacturing; George A. Burke, vice president in charge of special lubricating sales; L. S. Bales is manager of the company's two plants in Cleveland; A. H. Buchanan and L. B. Helm are superintendents at these plants. Assistant refinery superintendents are: C. H. Metz, Cleveland; Calvin Brown, Toledo.
[7]Stellar Refining Co.: A. W. Goldsbarry, chief chemist. W. V. Buchanan is general manager.
[8]Gulf Refining Co.: John H. Shriever, assistant refinery superintendent.

OKLAHOMA

Anderson-Prichard Oil Corp.	Cyril	5,000	S-C	3,000	Winkler-Koch	M. B. Burruss*		C. L. Mayhall	C. H. Dresser
Barnsdall Refineries, Inc.	Barnsdall	5,000	Comp.	4,000	Cross	V. R. Oakley		H. M. Edinger	
Barnsdall Refineries, Inc.	Okmulgee	11,000	Comp.	4,500	Cross	G. T. Granger		See above	
Bell Oil & Gas Co.	Grandfield	3,500	S-C	1,300	Dubbs	Mark Finston		Albert Finston	Albert Finston
Black Gold Refining Co.	Oklahoma City	1,500	S	....		W. E. Netherlin	Dan A. Corcoran	Charles W. Scott	Charles W. Scott
Capital Prod. & Ref. Co.	Oklahoma City	3,500	S	....		A. R. Stribling	N. R. Wage	E. C. Check	E. C. Check
Century Petroleum Co.	Tulsa	2,500	S	....		Matthew Nelson			
Century Petroleum Co.	Oklahoma City	2,500	S	....		J. D. Wrather			
Champlin Refining Co.	Enid	16,000	Comp.	4,000	Cross, Winkler-Koch	E. J. Slater		L. A. Snyder	A. H. Holland
Continental Oil Co.	Ponca City	30,000	S-C-L-Wax	9,000	Dubbs	Fred G. Fellows	Ray Russell	H. J. Kennedy	H. J. Kennedy
Continental Oil Co.	Sapulpa	4,000	S-C	1,500	Cross	K. W. Shimeall	See above	See above	See above
Crump Refining Co.	Oklahoma City	2,000	S-L	....		W. D. King		E. van Bogaert	E. van Bogaert
Cushing Ref. & Gasoline Co.	Cushing	4,000	S	....		F. A. Davis		E. O. Derrick	E. O. Derrick
Cushing Ref. & Gasoline Co.	Blackwell	1,500	S	....		F. C. Hutchinson		See above	See above
Deep Rock Oil Corp.	Cushing	10,000	S-C-L-Wax	7,800	Dubbs	W. E. Moody	R. G. Davis	B. L. Majewski	B. L. Majewski

PLUMB

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UPPLY COMPANIES

Survey of Operating Refineries in United States

Personnel and Plant Data

OKLAHOMA (Continued)

Name and general offices—	President	Vice President	Secretary	Treasurer	Purchasing agent
Eason Oil Co., Enid[9]	T. T. Eason	L. D. Hinman	T. W. Eason	T. W. Eason	A. C. Hatton
Empire Oil & Refining Co., Bartlesville and Tulsa[10]	Henry L. Doherty	H. R. Straight	C. E. Murray	R. L. Morton, Jr.	G. A. Thompson
Empire Oil & Refining Co., Bartlesville and Tulsa	See above	See above	See above	See above	See above
Garber Refinery, Inc., Garber	C. E. Pierce	Roy R. Ayers*	Stanley D. Letcher	Stanley D. Letcher	H. L. Welton
Globe Oil & Refining Co., Box 820, Blackwell[11]	I. A. O'Shaughnessy	F. L. Jehle*	R. E. Everitt	E. A. Lentz	F. L. Jehle
Globe Oil & Refining Co. of Delaware, Blackwell	See above	See above	See above	See above	See above
Illinois Oil Co., 24 Fourth Ave., Rock Island, Ill.	Frank P. Welch*	J. W. Armstrong	F. R. Edwards	F. R. Edwards	George Walker
Imperial Refining Co., Box 2011, Tulsa	W. B. Hassett	S. H. Fredericks	W. E. N. Phillips	W. B. Hassett	
Johnson Oil Refining Co., 178 W. Adams St., Chicago, Ill.[12]	I. H. Johnson	L. R. Johnson	G. C. Lilly	G. C. Lilly	A. L. Olson
Marathon Oil Co., Thompson Bldg., Tulsa[13]	W. W. Fleming			J. L. Cook	C. S. Sherk
Marathon Oil Co., Thompson Bldg., Tulsa	See above	See above	See above	See above	See above
Mid-Continent Petroleum Corp., Cosden Bldg., Tulsa[14]	Jacob France	J. C. Denton	E. M. Rouzer	Charles Klein	C. A. Prichard
Peppers Gasoline Co., Box 858, Enid	C. C. Peppers*		H. H. Champlin	H. H. Champlin	C. C. Peppers
Peveto & Peacock Refining Co., 2205 E. Reno, Oklahoma City	Jno. H. Peacock, owner				
Producers & Refiners Corp., Independence, Kans.[15]	L. R. Crawford	John Fertig*	A. W. Heinemann	O. O. Holmgren	E. L. Chatfield
Phillips Petroleum Co., Bartlesville, Okla.[16]	Frank Phillips	Clyde Alexander*	O. K. Wing	O. K. Wing	H. E. Koopman
Pure Oil Co., 35 E. Wacker Drive, Chicago, Ill.[17]	H. M. Dawes	L. S. Wescoat	F. S. Heath	R. Warner	R. L. Parsons
Pure Oil Co., 35 E. Wacker Drive, Chicago, Ill.	See above	See above	See above	See above	See above
Rock Island Refining Co., Duncan[18]	L. B. Simmons	R. H. Brown	L. E. Kincannon	L. E. Kincannon	L. E. Kincannon
Sinclair Refining Co., 45 Nassau St., New York, N. Y.	See Indiana	See Indiana	See Indiana	See Indiana	See Indiana
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.	See Pennsylvania	See Pennsylvania	See Pennsylvania	See Pennsylvania	See Pennsylvania
Sunray Oil Co., Philcade Bldg., Tulsa[19]	C. H. Wright	R. S. McFarland*			
Texas Pacific Coal & Oil Co., Fort Worth National Bank Bldg., Fort Worth, Tex.	E. J. Marston	E. R. Lederer*	R. Seibel	R. Seibel	J. C. Davis
The Texas Company, Houston, Tex.	See Texas	See Texas	See Texas	See Texas	See Texas
Tidal Refining Co., Philcade Bldg., Tulsa	Noel Robinson	C. R. Barton	Y. P. Broome	F. A. Marsellus	P. W. Fenton
Western Oil Corp., Thompson Bldg., Tulsa	J. F. Darby	George W. Snedden	C. F. Lynde	C. F. Lynde	I. H. Patton, Jr.
Wewoka Refining Co., Wewoka	James E. Dunn	Earl Dunn			
White Oak Refining Co., 1432 Hunt Bldg., Tulsa[20]	Victor H. Smith	Louis W. Pratt	B. F. Green	Victor H. Smith	B. F. Green
White Oak Refining Co., 1432 Hunt Bldg., Tulsa	See above	See above	See above	See above	See above
H. F. Wilcox Oil & Gas Co., Sixth and Denver, Tulsa[21]	Homer F. Wilcox	G. A. Dye*	L. J. Yarbrough	M. P. Appleby	H. B. Ward
Wirt Franklin Petroleum Corp., Box 966, Ardmore[22]	Wirt Franklin*	F. M. Porter	Edward Galt	P. C. Dings	C. A. Franklin
Yale Oil Corp., Yale	L. B. Hancock	C. H. Gifford	F. B. Hancock*	F. B. Hancock	F. B. Hancock

*General manager.

[1]Anderson-Prichard Oil Corp.: G. H. Burruss, general manager; Mr. Mayhall is in charge of refined oil sales, and Mr. Dresser is in charge of industrial naphtha sales; W. E. Bates, chief chemist.

[2]Barnsdall Refineries, Inc.: George D. Locke, E. O. Bartlett, vice presidents; E. D. Gray, assistant refinery superintendent at Barnsdall; J. V. Brazier, assistant refinery superintendent at Okmulgee; E. R. Wiles, chief chemist.

[3]Capital Producing & Refining Co.: O. L. Woodrum, chief chemist.

[4]Century Petroleum Co.: Rollo W. Coleman, vice president; M. D. Kinsey, general manager; Frank Blackwood, pipe line superintendent.

[5]Champlin Refining Co.: Joe N. Champlin, vice president.

[6]Continental Oil Co.: W. H. Ferguson, E. J. Nicklos, E. S. Karstedt, W. W. Bruce, vice presidents; H. G. Osborn, assistant refinery manager; L. L. Davis, process division supervisor; A. Henriksen, chief chemist.

[7]Crump Refining Co.: T. L. Ray, chief chemist.

[8]Deep Rock Oil Corp.: F. C. Gordon, R. J. Graf, L. B. Riddle, W. E. Moody, E. J. McKay, B. L. Majewski, vice presidents; B. Frichot, chief chemist.

[9]Eason Oil Co.: G. B. Lyon, chief chemist.

[10]Empire Oil & Refining Co.: Frank R. Coates, W. A. Jones, H. D. Frueauff, F. C. Brown, A. W. Ambrose, vice presidents; P. M. Miskell, general manager; A. L. Davis, chief chemist.

[11]Globe Oil & Refining Co.: R. D. McCrum, chief chemist.

[12]Johnson Oil Refining Co.: J. J. Johnson, chairman of the board; F. P. Frey, chief chemist.

PENNSYLVANIA

Atlantic Refining Co., 260 S. Broad St., Philadelphia[1]	W. M. Irish	R. D. Leonard	W. M. O'Connor	R. H. Colley	M. F. Roberts
Atlantic Refining Co., 260 S. Broad St., Philadelphia	See above	See above	See above	See above	See above
Atlantic Refining Co., 260 S. Broad St., Philadelphia	See above	See above	See above	See above	See above
Bradford Oil Refining Co., Bradford[2]	J. H. Rose*	F. D. Korner	H. G. Barcroft	H. G. Barcroft	
Butler County Oil Refining Co., Butler County Oil Bldg., Butler	Receivers in equity:	J. A. Beck and R. H. McClestin.			
Canfield Oil Co., 3216 E. Fifty-fifth St., Cleveland, Ohio	Louis Carruth	Charles McLean	H. M. Carruth	J. A. Jackson	M. C. Dippel
Carnegie Refining Co., Box 543, Carnegie[3]	H. A. Logan	George L. Craft	W. C. Heasley	F. G. Bannerot	Robert Burr
Conewango Refining Co., N. Warren[4]	Fred G. Clark	Harry R. Lewis	P. C. Girard	P. C. Girard	Tom Moore
Continental Refining Co., Oil City[5]	A. F. Anderton	M. A. De Arman	J. W. Anderton	T. A. Anderton*	C. F. Felton
Crew-Levick Co., 400 N. Broad St., Philadelphia[6]	Henry L. Doherty	Charles E. Foster*	Walter W. Martin	Edward J. Hasse	E. D. Erney
Crystal Oil Works, Oil City[7]	Partnership	Partnership	Partnership	Partnership	J. A. Fawcett
W. H. Daugherty & Son Refining Co., Petrolia[8]	Dr. F. Sonneborn	S. B. Sonneborn	R. G. Sonneborn	M. Pick	T. M. Murphy*
Emlenton Refining Co., Emlenton	P. J. Bayer	H. J. Crawford	T. B. Gregory	S. Messer	
Franklin Creek Refining Corp., Franklin	Dr. F. Sonneborn	J. F. Roten	R. G. Sonneborn	M. Pick	C. H. Alsberg
Freedom Oil Works Co., Freedom[9]	Earle M. Craig	A. J. Minke	C. E. McKee	C. E. McKee	George J. Mohr
Freedom Oil Works Co., Freedom	See above	See above	See above	See above	See above
Gulf Refining Co., Frick Annex Bldg., Pittsburgh[10]	G. R. Nutty	Charles B. Buerger	W. J. Guthrie	J. E. Nelson	C. T. Marsh
Gulf Refining Co., Frick Annex Bldg., Pittsburgh	See above	See above	See above	See above	See above
Independent Refining Co., N. Seneca St., Oil City[11]	S. Messer	H. J. Crawford	P. S. Tarbox	E. P. Theobald	C. R. Keniston
Kendall Refining Co., Bradford[12]	Otto Koch	H. H. Greene	H. H. Greene	I. H. Shearer	J. B. Fisher
McKean County Refining Co., Bradford	S. Messer	J. D. Berry	G. B. Hunter	C. D. Berry	P. J. Megivern, Jr.
A. D. Miller Sons Co., 1801 Preble Ave., Pittsburgh	R. B. Miller	J. B. Miller*	O. B. Opsion	A. D. Miller III	J. B. Miller
Oil Creek Refining Co., Titusville	J. E. Fleming	F. J. McGraw*	M. D. Woods	George F. Fleming	G. L. Ehrhart
Pennsylvania Oil Products Refining Co., Warren	M. F. Cowden	George E. Muir	H. E. Lawrence	D. F. Cowden	
Pennsylvania Refining Co., S. & T. Bldg., Butler	John A. Beck	Wayne K. Glenn	Paul R. Beck	Paul R. Beck	
Pennsylvania Refining Co., S. & T. Bldg., Butler	See above	See above	See above	See above	
Pennzoil Co., Drake Theater Bldg., Oil City[13]	C. L. Suhr	J. F. Vandeventer	D. J. Cavanaugh	M. A. Brewster	W. R. Birkmayr
Pure Penn Refining Co., Clarendon	E. H. Beshlin	H. G. Eaton	C. D. Blair	C. D. Blair	C. D. Blair
Pure Oil Co., 35 E. Wacker Drive, Chicago, Ill.[14]	H. M. Dawes	L. S. Wescoat	F. S. Heath	R. Warner	G. L. Parsons
Sinclair Refining Co., 45 Nassau St., New York, N. Y.	See Indiana	See Indiana	See Indiana	See Indiana	See Indiana
Starlight Refining Co., Karns City	W. J. Anderson	Zeno Henninger	M. P. Anderson	W. J. Anderson	C. E. Pickard*
Sun Oil Co., 1608 Walnut St., Philadelphia[15]	J. Howard Pew	A. E. Pew, Jr.	Frank Cross	Frank Cross	W. H. Booth
Superior Oil Works, Warren	Frank Morrison	F. C. Eaton	Fred B. Jackson	Herbert G. Eaton*	E. W. Smiley
Superior Oil Works, Warren	See above	See above	See above	See above	See above
Swan-Finch Refining Co., 205 E. 42nd St., New York, N. Y.[16]	Ernest V. Moncrieff	Howard F. Moncrieff	Charles B. Dwyer	Munson Burton	W. A. Covert
The Texas Company, Houston, Tex.	See Texas	See Texas	See Texas	See Texas	See Texas
Tiona Refining Co., 1136 Widener Bldg., Philadelphia	E. M. Lyons	C. A. Boler	William A. Powell	William A. Powell	
United Refining Co., Warren[17]	F. G. Bannerot	H. A. Logan	H. W. Schmidt	H. A. Logan*	
Valvoline Oil Co., 165 Broadway, New York, N. Y.	W. Dixon Ellis	H. W. Nuckols*	C. C. Gould	C. C. Gould	K. C. Wyckoff
Valvoline Oil Co., 165 Broadway, New York, N. Y.	See above	See above	See above	See above	See above
Viking Oil Corp., Clarendon	L. C. Jamieson	R. W. Clark	R. W. Clark	L. C. Jamieson	George W. Seager
Waverly Oil Works Co., Fifty-fourth St., Pittsburgh[18]	T. J. Hilliard*	H. R. Hilliard	J. E. Johnson	H. R. Hilliard	S. U. Symons
Waverly Oil Works Co., Fifty-fourth St., Pittsburgh	See above	See above	See above	See above	See above
Wolverine-Empire Refining Co., 51 Madison Ave., New York, N. Y., or Oil City[19]	C. H. Ellingwood	F. S. Smith	A. W. Scott	F. W. Baer	A. W. Scott
Wolverine-Empire Refining Co., 51 Madison Ave., New York, N. Y., or Oil City	See above	See above	See above	See above	See above

*General manager.

[1]Atlantic Refining Co.: J. W. Van Dyke, chairman of the board; W. D. Anderson, E. R. Cox, vice presidents; assistant refinery managers—W. F. Stroud, Jr., Philadelphia, B. H. Waterbury, Franklin, R. P. Horner, Pittsburgh; Dr. J. B. Hill, chief chemist; R. D. Leonard is in charge of domestic sales and W. D. Anderson is in charge of export sales.

[2]Bradford Oil Refining Co.: H. Salisbury, chief chemist.

[3]Carnegie Refining Co.: Charles E. Howk, chief chemist.

[4]Conewango Refining Co.: A. A. Gohn, assistant refinery superintendent; R. S. Dawson, chief chemist.

[5]Continental Refining Co.: E. F. Hanna, chief chemist.

[6]Crew-Levick Co.: R. M. Shanklin, Andrew M. McBurney, H. D. Frueauff, vice presidents; J. W. Griswold, manager of refineries; E. C. Mackey, construction engineer; E. F. Burch, chief chemist.

[7]Crystal Oil Works: E. V. Selden and J. A. Fawcett are members of the partnership; Roy Toy, chief chemist.

[8]W. H. Daugherty & Son Refining Co.: Dr. F. W. Breth, chief chemist. Petrolatum specialty.

[9]Freedom Oil Works Co.: Albert B. Craig, vice president; F. L. Way, chief chemist.

[10]Gulf Refining Co.: W. V. Hartmann, J. W. Williams, vice presidents; Charles R. Stevenson, manager of Texas refineries; George L. Prichard, general manager.

Survey of Operating Refineries in United States

Personnel and Plant Data

OKLAHOMA (Continued)

Name of company—	Plant location	Daily crude capacity	Type plant	Daily crack. capacity	Type cracking unit	Plant superintendent	Chief engineer	Sales Managers— Tank car	Sales Managers— Bulk and service station
Eason Oil Co.	Enid	5,000	S-C	2,000	Jenkins	P. G. Maranville		R. H. Rowland	J. D. Montgomery
Empire Oil & Refining Co.	Ponca City	11,000	S-L-C	5,000	Dubbs and Doherty	R. R. Mills	Clay Bridges	O. J. Tuttle	C. A. Willis
Empire Oil & Refining Co.	Okmulgee	4,000	S-L-C	1,000	Doherty	D. V. Eels	See above	See above	See above
Garber Refinery, Inc.	Garber	5,000	S-C	1,500	Jenkins	H. L. Welton		Omar Ref. Co., Tulsa	
Globe Oil & Refining Co.	Blackwell	3,000	S-C	4,000	Winkler-Koch, Cross	O. D. Gurley		A. E. Landsittel	A. E. Landsittel
Globe Oil & Refining Co.	Cushing	15,000	S-C	4,000	Jenkins	See above		See above	See above
Illinois Oil Co.	Cushing	2,500	S-C	1,500		P. J. Glover	S. M. Wilson	Ed Donnelly	Ed Donnelly
Imperial Refining Co.	Ardmore	6,000	S-C	2,000	Dubbs	J. F. Reardon*		J. B. Saunders	J. B. Saunders
Johnson Oil Refining Co.	Cleveland	6,500	S-C	3,000	Dubbs	W. J. Leenhouts		H. G. Plane	Grafton Houston
Marathon Oil Co.	Bristow	5,000	S-C	450	Slagter	W. M. Fraser		H. J. Scott	H. J. Scott
Marathon Oil Co.	Boynton	2,500	S-C	900	Slagter	T. L. Miller		See above	See above
Mid-Continent Petroleum Corp.	Tulsa	40,000	S-C-L-W	12,000	Mid-Continent	F. B. Koontz		R. W. McDowell	R. W. McDowell
Peppers Gasoline Co.	Covington	1,000	S	....		C. R. Williamson			
Peveto & Peacock Refining Co.	Oklahoma City	2,500	S	....		Lad Shoemaker	Lad Shoemaker	John H. Peacock	John H. Peacock
Producers & Refiners Corp.	Tulsa	6,000	S-C	3,000	Dubbs	John Cutter	Peter Vilkas	A. T. Smith	B. L. Meece
Phillips Petroleum Co.	Okmulgee	6,000	S-C-L	3,000	Dubbs	R. D. Evans	A. H. Riney	M. E. Foster	R. C. Jopling
Pure Oil Co.	Muskogee	13,000	S-C	5,800	Gyro and Cross	J. A. McBride	D. E. Sullivan	C. W. Feldmeier	G. C. Morris
Pure Oil Co.	Ardmore	2,700	S-C	3,000	Dubbs	J. Jeffrey	See above	See above	See above
Rock Island Refining Co.	Duncan	4,000	S-C	1,800	Winkler-Koch	A. L. Rayburn		E. J. Glover	E. J. Glover
Sinclair Refining Co.	Sand Springs	8,000	Comp.	4,000	Cross	C. R. McKay	See Indiana	See Indiana	See Indiana
Sun Oil Co.	Yale	6,000	S	....		C. B. Carter		S. B. Eckert	C. B. Eckert
Sunray Oil Co.	Allen	7,000	S	....		R. L. Johnson		F. L. Martin	F. L. Martin
Texas Pacific Coal & Oil Co.	Wynnewood	3,000	S-C	900	Dubbs	T. A. Pomeroy	H. H. Pruitt	F. D. Bostaph	M. Farnsworth
The Texas Company	West Tulsa	14,000	Comp.	15,000	Holmes-Manley	P. L. Drake	See Texas	See Texas	See Texas
Tidal Refining Co.	Drumright	18,000	S-C	7,000	Tube & Tank, Burton	R. S. Stanfield			
Western Oil Corp.	Duncan	2,000	S	....		A. R. Stribling		I. H. Patton, Jr.	I. H. Patton, Jr.
Wewoka Refining Co.	Wewoka	1,500	S	....		Harry Hunter		L. O. Carter Co.	
White Oak Refining Co.	Allen	3,000	S-L-C	2,000	Jenkins	E. M. Coffey	A. H. Mayo	M. B. Tichenor	M. B. Tichenor
White Oak Refining Co.	Oklahoma City	3,000	S-L	....		A. H. Mayo	See above	See above	See above
H. F. Wilcox Oil & Gas Co.	Bristow	5,000	S-C	1,200	Dubbs	P. I. Tinkler	W. R. Bingham	A. M. Ballard	A. M. Ballard
Wirt Franklin Petroleum Corp.	Ardmore	4,000	S	....		A. M. Edmiston		C. A. Franklin	W. L. Myers
Yale Oil Corp.	Yale	2,000	S	....		W. Shaw			

[13]Marathon Oil Co.: A. J. Slagter, general superintendent of refineries; Mr. Miller is acting superintendent at the Boynton plant; Joseph Turvey, assistant refinery superintendent at Bristow.

[14]Mid-Continent Petroleum Corp.: R. W. McDowell, G. O. Moody, F. B. Koontz, vice presidents; Mr. Koontz is in charge of manufacturing; D. G. Morgan is assistant superintendent of refineries; H. T. Bennett, chief chemist.

[15]Producers & Refiners Corp.: R. E. Wertz, vice president; J. A. Sartori, general manager of refineries; A. B. Lort, chief chemist.

[16]Phillips Petroleum Co.: L. E. Phillips, J. H. Kane, W. N. Davis J. S. Dewar, J. M. Sands, P. J. McIntyre, C. R. Musgrave, H. A. Trower, F. E. Rice, H. E. Koopman, vice presidents; M. P. Youker, manager of refineries; H. W. Sullivan, chief chemist.

[17]Pure Oil Co.: C. B. Watson, R. W. McIlvaine, N. H. Weber, R. Warner, vice presidents; G. T. Yost, assistant refinery superintendent at Muskogee; B. Wallace, assistant refinery superintendent at Ardmore; C. R. Wagner, chief chemist.

[18]Rock Island Refining Co.: C. V. May, chief chemist.

[19]Sunray Oil Co.: R. P. Abele, vice president; F. L. Martin is general manager of the refinery.

[20]White Oak Refining Co.: W. G. Johnson, vice president.

[21]H. F. Wilcox Oil & Gas Co.: F. H. Dunn, M. P. Appleby, vice presidents.

[22]Wirt Franklin Petroleum Corp.: C. A. Franklin, F. M. Head, vice presidents; Hugh Neal, chief chemist.

PENNSYLVANIA

Atlantic Refining Co.	Philadelphia	50,000	Comp.	22,600	Lewis & Cross	H. M. Nichols	W. Samans	R. D. Leonard	W. D. Anderson
Atlantic Refining Co.	Franklin	9,000	Comp.	6,000	Cross	G. E. Glines	See above	See above	See above
Atlantic Refining Co.	Pittsburgh	8,000	Comp.	4,000	Cross	G. H. Weaver	See above	See above	See above
Bradford Oil Refining Co.	Bradford	1,500	L	....		W. R. Reck	Charles Reck	James Lewis	James Lewis
Butler County Oil Refining Co.	Bruin	1,000	C-L-W	500	Own	C. J. McCorry*	R. J. Ellenberger	F. J. McCorry	C. R. Halleran
Canfield Oil Co.	Coraopolis	1,000	L	....		R. W. Helm			
Carnegie Refining Co.	Carnegie	1,000	L-W	....		Robert Burr		J. Earl French	
Conewango Refining Co.	Warren	2,000	L	....		W. L. Gettings	A. A. Gohn	David C. Hughes	
Continental Refining Co.	Oil City	1,500	L-C-W	250	Dubbs	J. C. Vogan		C. F. Felton	C. F. Felton
Crew-Levick Co.	Titusville	3,000	L-C	5,000	Doherty	C. E. Kinder	J. W. Griswold	A. H. Irelan	A. M. McBurney
Crystal Oil Works	Oil City	1,000	L	....		W. B. Graham	Henry McFadden	J. A. Fawcett	J. A. Fawcett
W. H. Daugherty & Son Co.	Petrolia	2,000	L	....		C. E. McGinnis	D. A. Schoerke	A. L. Larkin	
Emlenton Refining Co.	Emlenton	2,000	L-C	750	Dubbs	E. E. Ebner		A. R. Newton, Jr.	
Franklin Creek Refining Corp.	Franklin	1,000	L	....		C. E. McElhiney		C. H. Alsberg	
Freedom Oil Works Co.	Freedom	2,000	L-C	500	Dubbs	B. L. Heath		R. B. McKee	O. W. Fanner
Freedom Oil Works Co.	Coraopolis	500	L	....		Plant shut down			
Gulf Refining Co.	Philadelphia	40,000	Comp.	8,000	Gulf	L. R. Jones		W. V. Hartmann	W. V. Hartmann
Gulf Refining Co.	Pittsburgh	6,000	S-C	3,000	Gulf	J. H. Wackenhut		See above	See above
Independent Refining Co.	Oil City	1,800	L-C	700	Snodgrass	H. E. Shoemaker		C. R. Keniston	C. R. Keniston
Kendall Refining Co.	Bradford	3,500	L-C-W	1,000	Dubbs	Earl E. Bown	S. M. Wolbert	I. H. Shearer	J. B. Fisher
McKean County Refining Co.	Farmers Valley	2,500	L	....		Carl Anderson	W. H. Rockman*	K. B. Ogilvie	K. B. Ogilvie
A. D. Miller Sons Co.	Pittsburgh	1,000	L-W	....		O. B. Opsion	William Clowes	J. B. Miller	E. R. Price
Oil Creek Refining Co.	E. Titusville	1,000	L-W	....		F. J. McGraw		M. D. Woods	M. D. Woods
Pennsylvania Oil Products Co.	Eldred	1,000	L-C	1,000	Conerty	S. Stannard	S. Stannard	H. S. Hayden	H. S. Hayden
Pennsylvania Refining Co.	Karns City	1,500	L-W	....		Walter W. Beck*			
Pennsylvania Refining Co.	Titusville	1,000	L-W	....		See above			
Pennzoil Co.	Oil City	7,000	L-C-W	5,000	Dubbs	L. D. Fulton	W. S. Zehrung	D. J. Cavanaugh	R. A. Browne
Pure Penn Refining Co.	Clarendon	500	S	....		Theodore Mohr	H. A. Ross	J. R. Phillips	J. R. Phillips
Pure Oil Co.	Marcus Hook	18,000	S-C	11,600	Cross & Gyro	E. A. McCadden	D. E. Sullivan	See Oklahoma	See Oklahoma
Sinclair Refining Co.	Marcus Hook	20,000	S-C	10,000	Isom	Will Argyle	See Indiana	See Indiana	See Indiana
Starlight Refining Co.	Karns City	300	S-L	....		C. E. Pickard		W. J. Anderson	W. J. Anderson
Sun Oil Co.	Marcus Hook	40,000	S-L-A-C	12,000	Cross	W. D. Mason		S. B. Eckert	S. B. Eckert
Superior Oil Works	Warren	500	S-L-W	....		H. F. Cogswell		W. L. Baumbach	W. L. Baumbach
Superior Oil Works	Warren	750	L-W	....					
Swan-Finch Refining Co.	Warren	1,000	L-W	....		Harry S. Peterson	H. S. Peterson	W. A. Covert	W. A. Covert
The Texas Company	Marcus Hook	1,500	A	....		C. G. Cramer	See Texas	See Texas	See Texas
Tiona Refining Co.	Clarendon	1,000	L-W	....		H. W. Walchli			
United Refining Co.	Warren	1,500	L-W	....		H. J. Miner	MacLean Houston	H. A. Logan	H. W. Schmidt
Valvoline Oil Co.	Warren	1,000	S-L-W	....		F. C. Eaton		H. W. Nuckols	H. W. Nuckols
Valvoline Oil Co.	E. Butler	3,000	S-L-W	....		H. C. Eaton	See above	See above	See above
Viking Oil Corp.	Clarendon	1,000	L-W	....		George W. Seager			
Waverly Oil Works Co.	Coraopolis	3,000	S-C	1,500	Cross	W. H. Millhiser		L. L. Long	J. B. Fisher
Waverly Oil Works Co.	Pittsburgh	1,000	S-C-L-W	1,000	Cross	See above		See above	See above
Wolverine-Empire Refining Co.	Reno	1,000	S-L-W	....		A. W. Cole	T. G. Workman	H. F. Krathge	H. F. Krathge
Wolverine-Empire Refining Co.	Tidioute	700	S-L-W	....		See above	See above	See above	See above

[11]Independent Refining Co.: R. R. Buckham, chief chemist; Frank Pfaff, assistant refinery manager.

[12]Kendall Refining Co.: Joseph H. Bovaird, vice president; assistant refinery managers —Lon Crawford, Francis Healy; Frank Philippbar, chief chemist.

[13]Pennzoil Co.: A. S. Matthews, vice president; D. J. Harvey, superintendent of Plant No. 2; J. M. Hinman and M. E. Koffard, assistant refinery superintendents; P. M. Robinson, chief chemist.

[14]Pure Oil Co.: C. B. Watson, R. W. McIlvaine, N. H. Weber, R. Warner, vice presidents; J. J. Grace, assistant refinery superintendent at Marcus Hook; C. R. Wagner, chief chemist.

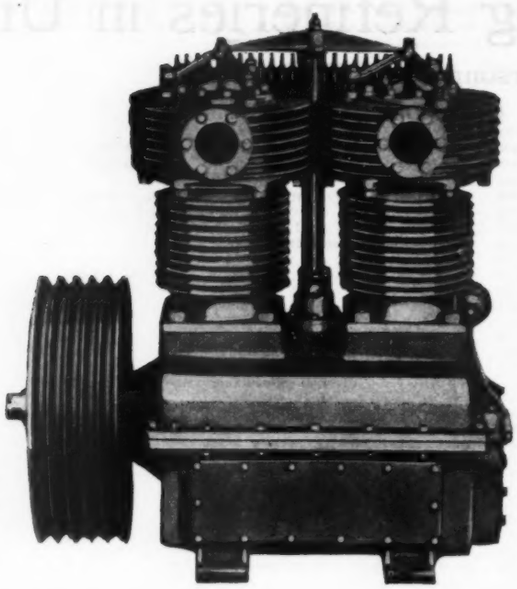
[15]Sun Oil Co.: J. N. Pew, Jr., S. B. Eckert, J. Edgar Pew, vice presidents; Dr. Gellert Alleman, chief chemist.

[16]Swan-Finch Refining Co.: Munson Burton, vice president; I. Klein, assistant refinery superintendent; H. S. Peterson, chief chemist.

[17]United Refining Co.: Herbert Wagner, chief chemist.

[18]Waverly Oil Works Co.: Assistant superintendent of refineries, Robert F. Kunz; W. T. Sieber, chief chemist.

[19]Wolverine-Empire Refining Co.: E. W. Chase, chairman of the board and general manager; P. V. Ruhlman and M. F. Spencer, assistant refinery superintendents; W. B. Smith, chief chemist.



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THREE men and a "Caterpillar"-mounted Davey Compressor cleaned pipe *right down to the bared metal* for the Henry L. Lemons, Inc. on their Continental Construction Co. project through Iowa, *thereby releasing 10 to 14 men for more profitable work* elsewhere along the line.

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AIR COOLED AIR

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That's a whole new idea in speeding up pipe-line work at a big saving in construction cost to the contractors and a big reduction in maintenance cost to the pipe line company. The "Caterpillar" Davey unit has made that possible for the first time. This is the only compressor-mounted tractor combination that travels *every*where, works *any*where, along the pipe line, regardless of ground conditions; supplying an unfailing volume of compressed air at any spot on the job.

The Compressor is mounted on the Tractor and operates by a power take-off from tractor motor—without disturbing its balance for draw-bar work and other usual operations.

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Name_____

Address_____

Post Office_____ State_____

Company_____ Position_____

Survey of Operating Refineries in United States

Personnel and Plant Data

RHODE ISLAND

Name and general offices—	President	Vice President	Secretary	Treasurer	Purchasing agent
Standard Oil Co. (New York), 26 Broadway, New York, N. Y.[1] ..	See New York	See New York	See New York	See New York	See New York
The Texas Company, Houston, Tex.[2]	See Texas	See Texas	See Texas	See Texas	See Texas

[1]Standard Oil Co. of New York: H. S. Musk, assistant refinery superintendent. [2]The Texas Company: F. T. Manley, in charge of refining department.

SOUTH CAROLINA

Standard Oil Co. of New Jersey, 26 Broadway, New York, N. Y..	See New Jersey	See New Jersey	See New Jersey	See New Jersey	See New Jersey

TEXAS

Allstate Refining Co., Thrall	H. H. Coffield	George P. Mann	J. H. Edwards	J. H. Edwards	
American Petroleum Co. of Texas, Houston	W. W. Moore, trustee	R. C. Tucker	G. L. Townsan	C. T. Carnes	
American Refining Properties, Waggoner Bldg., Wichita Falls[1]..	Controlled by committee of creditors		F. F. Florence	F. F. Florence	H. W. Yeager
Archer Refining Corp., Wichita Falls	George G. Golden	W. C. Hamilton	W. N. Yeargen	W. N. Yeargen	George G. Golden
Atlantic Pacific & Gulf Refining Co., Harvey Snider Bldg., Wichita Falls[2]	J. P. Howe	H. C. Miers	Glenn W. Byrd	C. E. Howe	W. F. de Haas
Big Spring Refining Co., Big Spring	R. S. Peterson	B. Rabinowitz	Charles R. Groff	Charles R. Groff	
Bluebonnet Oil Refining Co., 1507 Magnolia Bldg., Dallas	B. L. Wooley*		C. R. McClennahan	B. L. Wooley	
Burford Oil Co., 301 Beacon Life Bldg., Tulsa, Okla.[3]	F. W. Burford*	J. J. Thomas	E. F. Griswold	J. E. Woodworth	J. J. Thomas
Col-Tex Refining Co., Colcord Bldg., Oklahoma City, Okla.[4]...	L. H. Prichard	J. Steve Anderson	P. H. Anderson	P. H. Anderson	W. M. Sturges
Continental Oil Co., Ponca City, Okla.	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma
Cosden Oil Co., Electric Bldg., Fort Worth[5]	J. S. Cosden	George N. Moore	J. E. Whitney	J. E. Whitney	E. E. Brogdan
Crown Central Petroleum Corp., First National Bank Bldg., Houston[6]	W. A. Williams	M. C. Ehlen	James T. Bowles	Jacob Blaustein	Sam Jones
Dale Oil & Refining Co., 412 City National Bank Bldg., Wichita Falls	D. G. Gray*	Jack B. Dale	J. D. Dale	J. D. Dale	George A. Jennings
Deepwater Oil Refineries, Inc., 832 First National Bank Bldg., Houston	F. M. Law	L. F. Rothermel*	E. F. Harrell	E. L. Neville	J. W. Painter
Deer Oil Corp., Luling†	W. G. Johnson	K. C. Woodruff	B. F. Green	B. F. Green	J. A. Owens
Deer Oil Corp., Luling	See above	See above	See above	See above	See above
Dixon Creek Oil & Refining Co., Amarillo Bldg., Amarillo[7].....	S. D. McIlroy	W. W. McIlroy	G. W. Pennington	G. W. Pennington	George H. McGrath
East Texas Refining Co., Henderson[8]	F. W. Burford	J. J. Thomas	R. E. Bishop	E. V. Campbell	J. J. Thomas
East Texas Refining Co., Henderson	See above	See above	See above	See above	See above
Empire Oil & Refining Co., Bartlesville and Tulsa, Okla.	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma
Falls Refining Co., Inc., Wichita Falls	H. W. Roberts, owner and general manager				
Golden West Oil Co., 516 N. San Marcos St., San Antonio[26]	Richard Detert	W. E. Olmstead*	Harry Corvin	Judson Reeves	W. H. Olmstead
Great West Refining Co., Wichita Falls	R. S. Allen	H. E. Clark	G. T. West	G. T. West	
Grayburg Oil Co., Smith-Young Tower, San Antonio[27]	Frank E. Kistler*	Charles F. Carnine	Charles Barsun	Adolph C. Toupal	John W. Sweeney
Gulf Refining Co., Frick Bldg. Annex, Pittsburgh, Pa.	See Pennsylvania	See Pennsylvania	See Pennsylvania	See Pennsylvania	See Pennsylvania
Gulf Refining Co., Frick Bldg. Annex, Pittsburgh, Pa.	See Pennsylvania	See Pennsylvania	See Pennsylvania	See Pennsylvania	See Pennsylvania
Gulf Refining Co., Frick Bldg. Annex, Pittsburgh, Pa.	See Pennsylvania	See Pennsylvania	See Pennsylvania	See Pennsylvania	See Pennsylvania
Houston Oil Co., Petroleum Bldg., Houston[9]	E. H. Buckner	L. S. Zimmerman	A. H. Kennerly	L. S. Zimmerman	M. L. Clark
Houston Oil Terminal Co., 1019 Post Dispatch Bldg., Houston[10]..	George L. H. Koehler*	A. E. Kerr	W. M. Cleaves	George L. H. Koehler	T. A. Murphy
Humble Oil & Refining Co., 1216 Main St., Houston[11]	W. S. Farish	R. L. Blaffer	F. O. Freese	R. L. Blaffer	J. M. Stitler
Humble Oil & Refining Co., 1216 Main St., Houston	See above	See above	See above	See above	See above
Humble Oil & Refining Co., 1216 Main St., Houston	See above	See above	See above	See above	See above
Humble Oil & Refining Co., 1216 Main St., Houston	See above	See above	See above	See above	See above
Humble Oil & Refining Co., 1216 Main St., Houston	See above	See above	See above	See above	See above
Humble Oil & Refining Co., 1216 Main St., Houston	See above	See above	See above	See above	See above
Humble Oil & Refining Co., 1216 Main St., Houston	See above	See above	See above	See above	See above
Iowa Park Producing & Refining Co., 349 Harvey-Snider Bldg., Wichita Falls	J. F. Boyd	P. J. Gwynn*	J. D. Overby	Tom Corridon	
LaSalle Petroleum Co., 608 Wright Bldg., Tulsa, Okla.[12]	John A. Prescott	W. J. Schnur*	R. B. Martin	W. E. Bennett	J. E. Tanner
Macmillan Petroleum Corp., 530 W. Sixth St., Los Angeles, Calif.	R. S. Macmillan	Alfred Macmillan	Joseph Zeppa	Joseph Zeppa	
Magnolia Petroleum Co., Box 900, Dallas[13]	E. R. Brown	B. H. Stephens*	Courtenay Marshall	W. C. Proctor	John P. David
Magnolia Petroleum Co., Box 900, Dallas	See above	See above	See above	See above	See above
Magnolia Petroleum Co., Box 900, Dallas	See above	See above	See above	See above	See above
Magnolia Petroleum Co., Box 900, Dallas	See above	See above	See above	See above	See above
Magnolia Petroleum Co., Box 900, Dallas	See above	See above	See above	See above	See above
Magnolia Petroleum Co., Box 900, Dallas	See above	See above	See above	See above	See above
Marathon Oil Co., Box 2064, Tulsa, Okla.	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma
Marathon Oil Co., Box 2064, Tulsa, Okla.	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma
Misko Refineries, Inc., 1020 Salinas Ave., Laredo[14]	O. W. Killam	W. T. Killam	J. C. Garnett	W. T. Killam	Kent W. Bartlett*
Motor Fuel Products Co., Box 325, Laredo	S. P. Coblentz*	N. C. McGowen	W. W. Chapman	J. B. Huff, Jr.	R. A. Reeder
Muenster Refining Co., Muenster	A. G. Hutton, owner and general manager				
Nacogdoches Refinery, Inc., Nacogdoches	A. V. Raplee	Neil F. Blaine	E. L. Jordon	E. E. Jordon	
Olney Oil & Refining Co., Wichita Falls	R. S. Allen	J. M. Bradshaw	R. G. Cocanower*	R. G. Cocanower	
Oriental Oil Co., 1911½ Pacific St., Dallas	W. R. Smith	F. M. Smith	D. G. White	F. M. Smith	B. H. Pittman
Panhandle Refining Co., Box 1107, Wichita Falls[15]	Roy B. Jones*	M. A. Chambers	R. C. Stanford	M. A. Chambers	R. J. Mann
Pasotex Petroleum Co., 225 Bush St., San Francisco, Calif[16]....	K. R. Kingsbury	H. D. Collier	J. H. Tuttle	V. F. Palmer	
Petroleum Conversion Corp., 136 Liberty St., New York, N. Y.[17]	Fred B. Lloyd	E. W. Beardsley	William A. Fine	Walter M. McFarland	E. Blanckenburg
Petroleum Refractionating Corp., Box 1929, Tulsa, Okla.[18]	Joseph Danciger	Mark Finston*	W. Vaeth	Dan Danciger	A. M. Martin
Phillips Petroleum Co., Bartlesville, Okla.	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma
Pioneer Oil & Refining Co., 604 Caroline St., San Antonio	A. B. Slimp	H. C. King, Jr.	M. L. Roark	M. L. Roark	
Primrose Refining Co., Box 1455, Wichita Falls	H. D. Brin	S. E. Brin	E. Garonzik	E. Garonzik	H. J. Strief*
Pure Oil Co., 35 E. Wacker Drive, Chicago, Ill.	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma
Richardson Refining Co., 1603 Electric Bldg., Fort Worth[19]	W. D. Richardson*	Stanley Cosden	C. F. Dyckmans	C. F. Dyckmans	E. E. Brogdon
Rio Grande Oil Co., 417 S. Hill St., Los Angeles, Calif.	See California	See California	See California	See California	See California
San Angelo Refining Co., San Angelo	W. B. Hassett	George W. Buckner	W. L. Hassett	George W. Buckner	
Shell Petroleum Corp., Shell Corner, St. Louis, Mo.	See Illinois	See Illinois	See Illinois	See Illinois	See Illinois
Simms Oil Co., 1007 Magnolia Bldg., Dallas[20]	Edward T. Moore*	F. R. Schneider	L. W. Richards	D. H. Voss	W. J. Morrison
Sinclair Refining Co., 45 Nassau St., New York, N. Y.	See Indiana	See Indiana	See Indiana	See Indiana	See Indiana
Southland Refining Co., Olney	C. T. Wolverton*				
Star Refining & Producing Co., Arlington Heights, Fort Worth	W. M. Harrison	Herman Gartner	Clara Mabry	Clara Mabry	
Stone Oil Co., Second National Bank Bldg., Houston[21]	R. W. Stone	Henry M. Stone	Robert D. Breed	Robert D. Breed	
Superior Refining Co., Ranger	J. M. Weaver	G. A. Clements*	H. H. Porter	H. R. Gholson	J. H. Howlett
Sweetwater Oil & Refining Corp., Sweetwater			W. M. Jones	W. M. Jones	
Taxman Refining Co., Wichita Falls	J. J. Taxman*	Maynard Taxman	M. Taxman	M. Taxman	C. W. Hulland
Taylor Refining Co., Taylor National Bank Bldg., Taylor[22]	G. L. Rowsey*	J. M. Dodson	C. H. Booth, Jr.	C. H. Booth, Jr.	G. L. Rowsey
The Texas Company, Houston[23]	R. C. Holmes	C. B. Ames	E. M. Crone	C. E. Woodbridge	A. F. Colling
The Texas Company, Houston	See above	See above	See above	See above	See above
The Texas Company, Houston	See above	See above	See above	See above	See above
The Texas Company, Houston	See above	See above	See above	See above	See above
The Texas Company, Houston	See above	See above	See above	See above	See above
The Texas Company, Houston	See above	See above	See above	See above	See above
The Texas Company, Houston	See above	See above	See above	See above	See above
Texas Eagle Refining Co., 1701 Young St., Dallas	Ben Rabinowitz		E. Hunter*		Ben Rabinowitz
Texas Mexican Oil & Refining Co., Box 263, Laredo	M. T. Cogley		G. B. Carden	G. B. Carden	James T. Ryan*
Texas Pacific Coal & Oil Co., Thurber[24]	E. J. Marston	E. R. Lederer*	R. Seibel	R. Seibel	J. C. Davis
Texas Pacific Coal & Oil Co., Thurber	See above	See above	See above	See above	See above
Texas Petroleum Products Co., Medina and Colima Sts., San Antonio	Grover C. Shaw	C. L. Witherspoon	W. I. Lighthouse	W. I. Lighthouse	
Tidal-Western Oil Corp., Philcade Bldg., Tulsa, Okla.	Noel Robinson	C. R. Barton	Y. P. Broome	F. A. Marsellus	P. W. Fenton

Survey of Operating Refineries in United States

Personnel and Plant Data

RHODE ISLAND

Name of company—	Plant location	Daily crude capacity	Type plant	Daily crack. capacity	Type cracking unit	Plant superintendent	Chief engineer	Sales Managers— Tank car	Sales Managers— Bulk and service station
Standard Oil Co. of New York	Providence	10,000	A-C	6,000	Cross	C. W. Shaeffer	See New York	See New York	See New York
The Texas Company	Providence	1,500	A	....		T. Wall.	See Texas	See Texas	See Texas

SOUTH CAROLINA

Standard Oil Co. of New Jersey	Charleston	15,000	A-C	20,444	Tube & Tank	E. A. Rudigier	See New Jersey	See New Jersey	See New Jersey

TEXAS

Allstate Refining Co.	Thrall	3,000	S	....		George P. Mann		C. A. Middleton	C. A. Middleton
American Pet. Co. of Texas	Norsworthy	2,500	S	....		B. C. Cooke	B. C. Cooke	James P. Lavery	James P. Lavery
American Ref. Properties	Wichita Falls	6,000	S-C	2,800	Dubbs & Cross	D. F. Gerstenberger		W. L. Scott	W. R. Johnson
Archer Refining Co.	Megargel	1,500	S	....		W. N. Yeargen		George G. Golden	
Atlantic Pac. & Gulf Ref. Co.	Wichita Falls	3,000	S-C	3,000	Jenkins	R. W. Jacobs	R. W. Jacobs	W. F. de Haas	W. F. de Haas
Big Spring Refining Co.	Big Spring	3,500	S	....		H. O. Robertson			
Bluebonnet Oil Ref. Co.	Wickett	4,000	S	....		J. T. Miller		B. L. Wooley	B. L. Wooley
Burford Oil Co.	Pecos	6,000	S-C	3,000	Jenkins	J. J. Thomas		E. F. Griswold	
Col-Tex Refining Co.	Colorado	10,000	S-C	3,000	California	L. C. McLoud		C. L. Mayhall	C. L. Mayhall
Continental Oil Co.	Wichita Falls	6,000	S-C	2,000	Continental	D. H. Hyler	See Oklahoma	See Oklahoma	See Oklahoma
Cosden Oil Co.	Big Spring	10,000	S-C	10,000	Jenkins	E. J. Mary	J. A. Davis	F. L. Bunn	F. L. Bunn
Crown Central Pet. Corp.	Houston	13,000	S-C	8,000	Holmes-Manley	R. S. Myers	C. M. Johnson	J. Stickel	J. Stickel
Dale Oil & Ref. Co.	Electra	4,000	S	....		George A. Jennings		D. G. Gray	D. G. Gray
Deepwater Oil Refineries, Inc.	Houston	3,000	L	....		R. Q. Traweek		F. L. Rogers	D. E. Little
Deer Oil Corp.	Luling	1,500	S-C	1,000	Tube Still-Luling	J. E. Conner		Ray Uhlman	
Deer Oil Corp.	Brownwood	1,000	S	....		M. E. Bawcom		See above	
Dixon Creek Oil & Ref. Co.	Kings Mill	4,500	S	....		C. A. Hunter		J. A. Harris	
East Texas Refining Co.	Henderson	6,000	S	....		J. J. Thomas	J. J. Thomas	R. E. Bishop	
East Texas Refining Co.	Longview	6,000	S	....		See above	See above	See above	
Empire Oil & Ref. Co.	Gainesville	4,000	S-C	2,000	Dubbs	Curtis Bailey	Clay Briggs	O. J. Tuttle	C. A. Willis
Falls Refining Co.	Wichita Falls	2,500	S	....		T. P. Cannon		H. W. Roberts	H. W. Roberts
Golden West Oil Co.	Ina Field	350	L	....		W. H. Olmstead		W. H. Olmstead	W. H. Olmstead
Great West Refining Co.	Big Spring	7,000	S-C	1,500	Rowsey	J. C. Hinds		R. G. Cocanower	R. G. Cocanower
Grayburg Oil Co.	San Antonio	2,500	S-C	1,000	Dubbs	Frank Hovell	H. A. Sprowls	John E. Cronin	John E. Cronin
Gulf Refining Co.	Port Arthur	125,000	Comp.	61,000	Gulf	W. A. Slater		W. V. Hartmann	W. V. Hartmann
Gulf Refining Co.	Fort Worth	6,000	S-C	3,000	Combination	Herman Taylor		See above	See above
Gulf Refining Co.	Sweetwater	5,000	S-C	4,000	Gulf	B. H. Barnes		See above	See above
Houston Oil Co.	Viola	1,000	S	....		W. R. Hounsell	F. Y. Hutchinson		L. R. Sexton
Houston Oil Terminal Co.	Houston	3,000	S-A	....		T. A. Murphy		Frank Hermon	Frank Hermon
Humble Oil & Refining Co.	Baytown	125,000	S-C-L	143,000	Cross, Tube & Tank	F. N. Read	Dr. E. Voss	B. H. Brown	M. J. Monroe
Humble Oil & Refining Co.	Chilton	4,500	S	....		C. M. Dennison	See above	See above	See above
Humble Oil & Refining Co.	McCamey	15,000	S	15,000	Tube & Tank	W. H. Barber	See above	See above	See above
Humble Oil & Refining Co.	Neches	5,000	S	....		R. X. Cook	See above	See above	See above
Humble Oil & Refining Co.	Ingleside	15,000	S-C	15,000	Tube & Tank	G. L. Farned	See above	See above	See above
Humble Oil & Refining Co.	San Antonio	4,500	S	....		C. M. Bell	See above	See above	See above
Humble Oil & Refining Co.	Breckenridge	1,500	S	....		R. W. Way	See above	See above	See above
Iowa Park Prod. & Ref. Co.	Iowa Park	2,500	S-C	1,250	Jenkins	L. R. Medford		P. F. Gwynn	
LaSalle Petroleum Co.	Burkburnett	3,500	S-C	2,500	Jenkins	P. D. Williams		H. P. McCoy	H. P. McCoy
Macmillan Petroleum Corp.	Borger	2,000	S	....		W. F. Cereghino		DeRalph Frizell	S. M. Batterson
Magnolia Petroleum Co.	Beaumont	70,000	Comp.	55,000	Cross	C. S. Dickens	R. G. Sanders	E. P. Angus	E. P. Angus
Magnolia Petroleum Co.	Magpetco	10,000	S	....		W. W. White	See above	See above	See above
Magnolia Petroleum Co.	Fort Worth	4,500	S-C	3,000	Cross	John D. Ricker	See above	See above	See above
Magnolia Petroleum Co.	Fort Worth	2,600	S-C	750	Controlled Coil	Eugene Ritter	See above	See above	See above
Magnolia Petroleum Co.	Corsicana	4,000	S	....		W. C. Ralston	See above	See above	See above
Magnolia Petroleum Co.	Luling	5,000	S-C	3,750	Controlled Coil	J. T. Dickens	See above	See above	See above
Marathon Oil Co.	Fort Worth	5,000	Comp.	1,350	Slagter	W. R. Sonricker		H. J. Scott	H. J. Scott
Marathon Oil Co.	Del Rio	3,000	S	....		J. R. Barrott		See above	See above
Misko Refineries, Inc.	Mirando City	1,000	S-L-C	1,200	Misko	S. E. Davis		Kent W. Bartlett	Kent W. Bartlett
Motor Fuel Products Co.	Laredo	2,000	S-L-C	900	Jenkins	H. E. Read		M. E. Blake	
Muenster Refining Co.	Muenster	300	S	....		A. G. Hutton	A. G. Hutton	A. G. Hutton	A. G. Hutton
Nacogdoches Refinery, Inc.	Nacogdoches	1,500	L	....		Neil F. Blaine			
Olney Oil & Refining Co.	Olney	3,000	S-C	1,500	Olney	P. E. Slater		R. G. Cocanower	R. G. Cocanower
Oriental Oil Co.	Dallas	5,000	S	....		F. M. Floyd		B. H. Pittman	O. D. Martin
Panhandle Refining Co.	Wichita Falls	5,000	S-C	1,500	Dubbs	W. F. Sims		G. W. Reed	G. W. Reed
Pasotex Petroleum Co.	El Paso	14,000	S-C	3,800	Modified Richmond	C. E. Finney		S. E. Stretton	S. E. Stretton
Petroleum Conversion Corp.	Texas City	500	S-C	10,000	"True Vapor Phase"	D. M. Evans	Myron W. Colony		
Petroleum Refractionating Corp.	Pampa	6,500	S	....		Mark Finston		Albert Finston	Albert Finston
Phillips Petroleum Co.	Borger	25,000	S-C	7,500	Phillips	Hugh Miller	See Oklahoma	See Oklahoma	See Oklahoma
Pioneer Oil & Refining Co.	Somerset	2,000	S	....		H. B. Slimp		A. W. Nunn	A. W. Nunn
Primrose Refining Co.	Wichita Falls	2,500	S	....		C. J. Gibbs		H. J. Strief	H. J. Strief
Pure Oil Co.	Smiths Bluff	30,000	S-C-L-W	20,000	Cross, Gyro	R. L. Vernor	See Oklahoma	See Oklahoma	See Oklahoma
Richardson Ref. Co.	Big Spring	7,500	S-C	4,400	Jenkins	C. B. Faught		W. D. Richardson	
Rio Grande Oil Co.	El Paso	3,500	S	....		D. H. Driscoll		J. N. Reed	J. N. Reed
San Angelo Refining Co.	San Angelo	1,500	S	....				George W. Buckner	George W. Buckner
Shell Petroleum Corp.	Houston	22,000	S-C	11,000	Dubbs	R. B. High	See Illinois	See Illinois	See Illinois
Simms Oil Co.	Dallas	4,500	S-C	2,500	Cross	I. H. Lantz	Frank Gardner	F. R. Schneider	George D. Bowers
Sinclair Refining Co.	Houston	31,000	Comp.	20,000	Isom	Parker Kendall	See Indiana	See Indiana	See Indiana
Southland RefiningCo.	Olney	750	S	....				C. T. Wolverton	
Star Refining Co.	Fort Worth	1,500	S-C	200	Fleming	H. L. Pemberton		W. M. Harrison	C. E. Walker
Stone Oil Co.	Texas City	3,000	S-C	1,500	Jenkins	Henry M. Stone		R. W. Stone	R. W. Stone
Superior Refining Co.	Tiffin	1,500	S	....		J. W. Cash		G. A. Clements	G. A. Clements
Sweetwater Oil & Ref. Co.	Sweetwater	1,000	S	....					
Taxman Refining Co.	Wichita Falls	2,500	S	....		Earl C. Roff		J. J. Taxman	Maynard Taxman
Taylor Refining Co.	Taylor	7,600	S	....		J. F. Whitehurst	B. F. Perkinson	G. L. Rowsey	Mac Kennedy
The Texas Company	Port Arthur	60,000	Comp.	87,500	Holmes-Manley DeFlorez, Pressure Coke	T. G. Dellinger	L. R. Holmes	W. S. S. Rodgers	W. S. S. Rodgers
The Texas Company	Port Neches	20,000	A	....		F. S. Dengler	See above	See above	See above
The Texas Company	Houston	20,000	S-C	1,000	Tube & Tank	J. S. Worden	See above	See above	See above
The Texas Company	West Dallas	16,000	S-C	10,000	Holmes-Manley DeFlorez, Pressure Coke	R. E. Mossman	See above	See above	See above
The Texas Company	San Antonio	3,000	Comp.	3,000	Holmes-Manley	H. A. Fouts	See above	See above	See above
The Texas Company	Amarillo	3,000	Comp.	2,750	DeFlorez, Pressure Coke	W. R. Borough	See above	See above	See above
The Texas Company	El Paso	1,500	Comp.	1,500	Holmes-Manley	R. G. Collins	See above	See above	See above
Texas Eagle Refining Co.	Dallas	500	S	....		A. C. Dodson			
Texas Mexican Oil & Ref. Co.	Laredo	600	S-L	....		Joseph T. Ryan		Joseph T. Ryan	Joseph T. Ryan
Texas Pacific Coal & Oil Co.	Fort Worth	3,000	S-C-L	1,000	Cross	George Pfau	H. H. Pruitt	F. D. Bostaph	M. Farnsworth
Texas Pacific Coal & Oil Co.	Caddo	1,000	S	....		Dean Hiatt	See above	See above	See above
Texas Pet. Products Co.	Somerset	3,000	S	....		G. B. Dartois		Roy Wright	R. L. Shaw
Tidal-Western Oil Corp.	Burkburnett	3,000	S	....		D. J. Carey		Tide Water Oil Sales Corp.	

Automatic

Applications have been

THE further application of automatic control to refinery operations has been greatly extended during 1930. The outlook for 1931 points to still further developments of this trend. The illustrations on these two pages show a few examples of Brown Automatic Controls in a single modern refinery. The picture (8379) of the instrument board is that of a new installation for one of the latest M. W. Kellogg Company combined topping and cracking units. It includes flow controls, temperature controls, absolute pressure recorders and indicating and recording pyrometers—all of Brown make.

Another picture (8386) shows a Brown Control Mechanism connected by means of sprockets and chain to a Fisher Governor which regulates the speed of a large reciprocating steam-driven pump. It is only necessary for the operator to make a setting on his Brown instruments and this control automatically adjusts the regulator.

A third illustration (8371) shows a Brown Resistance Thermometer "Trend Analyzing" Recording Con-

Brown

To Measure

Control

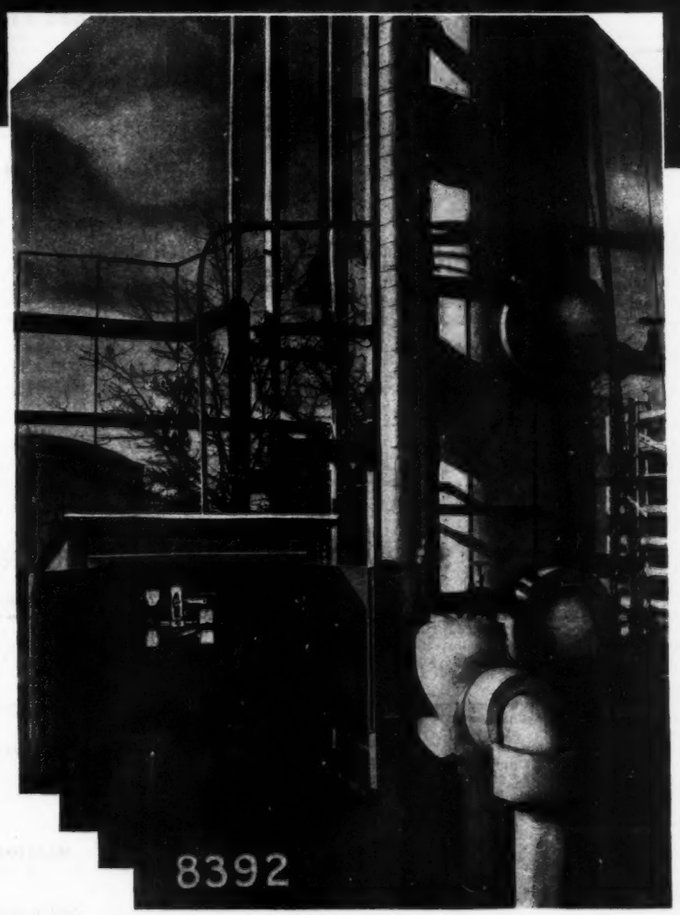
Greatly Extended During 1930

troller with Brown Pressure Gauge and Switch. This installation is controlling a very low temperature stabilizing column on a recovery plant. It is necessary for this control to regulate within 2° in order to produce gasoline efficiently.

The fourth illustration (8392) shows a Brown Control Mechanism governing the steam inlet to the kettle mounted in the bottom of the stabilizer referred to in the preceding paragraph.

Let Brown specialists in the development and application of instruments for oil refining processes work closely with your engineering staff. Write for consultation or information.

THE BROWN INSTRUMENT COMPANY
4488 Wayne Ave. Philadelphia, Pa.
Branches in 22 principal cities.



Automatic Controls

is to Economize

Survey of Operating Refineries in United States

Personnel and Plant Data

TEXAS (Continued)

Name and general offices—	President	Vice President	Secretary	Treasurer	Purchasing agent
Tonkawa Petroleum Co., Pyote	E. Constantin, Jr.	C. J. Constantin*	C. J. Constantin	C. J. Constantin	H. J. Toups
Waggoner Refining Co., Electra	W. T. Waggoner, Sr.	G. L. Waggoner	R. L. More	R. L. More	C. F. Klop*
Wickett Refining Co., Wickett[25]	W. B. Hassett	C. R. Armstrong	B. L. Wooley	W. B. Hassett	
H. F. Wilcox Oil & Gas Co., Tulsa, Okla.	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma

*General manager. †Deep Oil Corp.: 100 per cent owned subsidiary of White Oak Corp., Tulsa, Okla.

[1]American Refining Properties: Fred W. Catterall, chairman of creditors' committee; J. J. Perkins, vice chairman. E. H. Eddleman, general manager; R. E. Goode, chief chemist.

[2]Atlantic Pacific & Gulf Refining Co.: R. W. Jacobs, chief chemist.

[3]Burford Oil Co.: A. C. Sturgis, chief chemist.

[4]Col-Tex Refining Co: E. B. Willbanks, chief chemist, and G. H. Burruss, general manager.

[5]Cosden Oil Co.: A. G. Reed, vice president; R. W. Henry, assistant refinery superintendent and chief chemist.

[6]Crown Central Petroleum Corp.: Louis Blaustein, chairman of the board; Lee Leferney, general manager of refinery; H. A. Sheard, chief chemist.

[7]Dixon Creek Oil & Refining Co.: H. F. Allspaugh, general manager.

[8]East Texas Refining Co.: Refineries under construction and will start operating about April 1.

[9]Houston Oil Co.: A. H. Standing, general manager; W. R. Hounsell, chief chemist and manager of Viola refinery.

[10]Houston Oil Terminal Co.: T. A. Murphy, chief chemist.

[11]Humble Oil & Refining Co.: F. P. Sterling, H. C. Wiess, James Armstrong, W. W. Fondren, J. S. Bonner, vice presidents; J. L. Finley, general manager of refineries; assistant refinery superintendents: Baytown, W. R. Brison, M. L. Snyder, A. C. Kraft, C. E. Carlson; Ingleside, G. P. Curtin; McCamey, E. W. Hunt. S. P. Coleman, director of development and research.

[12]LaSalle Petroleum Co.: L. J. Lepper, vice president.

[13]Magnolia Petroleum Co.: W. H. Francis, W. C. Proctor, E. E. Plumly, F. V. Faulkner, E. P. Angus, D. C. Stewart, D. A. Little, Ralph Kinsloe, vice presidents; assistant refinery

UTAH

Diamond Oil Co., 304 Vermont Bldg., Salt Lake City[1]	John T. White	J. W. Musser*	John Shewell	John Shewell	J. W. Musser
Utah Oil Refining Co., Newhouse Bldg., Salt Lake City[2]	T. A. Dines	W. R. Wallace	A. N. Johnson	A. N. Johnson	W. H. Lovesy

*General manager.

[1]Diamond Oil Co.: Refinery temporarily shut down.

[2]Utah Oil Refining Co.: A. N. Johnson, M. J. Greenwood, vice presidents; Frank L. Arnold, assistant refinery superintendent; Gordon I. Kirby, chief chemist.

VIRGINIA

The Texas Company, Houston, Tex.	See Texas	See Texas	See Texas	See Texas	See Texas

WEST VIRGINIA

Elk Refining Co., Charleston[1]	H. A. Logan*	F. G. Bannerot	V. B. Ward	F. G. Bannerot	
Ohio Valley Refining Co., 201 Barkwell St., St. Marys[2]	J. P. Flynn	H. J. Crawford	W. R. Reitz	W. R. Reitz	J. B. Northrop
Pure Oil Co., 35 E. Wacker Drive, Chicago, Ill.[3]	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma
Standard Oil Co. of New Jersey, 26 Broadway, New York, N. Y.	See New Jersey	See New Jersey	See New Jersey	See New Jersey	See New Jersey
Tri-State Refining Co., Inc., Ashland, Ky.	Paul G. Blazer*	G. C. Davison	Homer E. Holt	R. W. Grossenbach	R. W. Grossenbach

*General manager.

[1]Elk Refining Co.: F. A. Nicholson, chief chemist.

WYOMING

Continental Oil Co., Ponca City, Okla.	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma	See Oklahoma
Egaso Operating Co., Osage[1]	Albert E. May		A. T. Lesley	Harry A. May	A. T. Lesley
Gillette Refining Co., Gillette	George E. Kiesling*	V. O. Stirnweis	D. B. Card	D. B. Card	
Hole's Pedro Refinery, New Castle	B. V. Hole*				B. V. Hole
Midwest Refining Co., First National Bank Bldg., Denver, Colo.[2]	Thomas A. Dines	H. G. Naylor	L. G. Truby	W. L. Greiner	A. G. Fidel
Midwest Refining Co., First National Bank Bld., Denver, Colo.	See above	See above	See above	See above	See above
Midwest Refining Co., First National Bank Bld., Denver, Colo.	See above	See above	See above	See above	See above
Producers & Refiners Corp., Box 449, Independence, Kans.[3]	L. R. Crawford	John Fertig*	A. W. Heinemann	O. O. Holmgren	C. D. Wells
The Texas Company, Houston, Tex.	See Texas	See Texas	See Texas	See Texas	See Texas
The Texas Company, Houston, Tex.	See Texas	See Texas	See Texas	See Texas	See Texas
The Texas Company, Houston, Tex.	See Texas	See Texas	See Texas	See Texas	See Texas
White Eagle Oil Corp., 1400 Federal Reserve Bank Bldg., Kansas City, Mo.	See Kansas	See Kansas	See Kansas	See Kansas	See Kansas
Wyoming Gas & Oil Co., Upton	C. F. Martens*			W. K. Paulson	

*General manager.

[1]Egaso Operating Co.: Cracking plant shut down.

[2]Producers & Refiners Corp.: W. R. Newman, assistant refinery superintendent; A. B. Lort, chief chemist at Parco.

[3]Midwest Refining Co.: 100 per cent owned subsidiary of the Standard Oil Co. of Indiana, and is known as the Rocky Mountain division. M. G. Paulus is manager in the division; J. E. Rouse is general superintendent of the Casper plants; R. M. Andrus is

SURVEY OF OPERATING REFINERIES IN CANADA

ALBERTA†

Imperial Oil, Ltd., 56 Church St., Toronto, Ontario	See Ontario	See Ontario	See Ontario	See Ontario	See Ontario
Maple Leaf Oil & Refining Co., Ltd., The, Coutts[1]	W. D. Craig		R. R. Davidson	W. E. Rice	Tom Pittman
Northwest Stellarene Co., Inc., Shelby, Montana, U. S. A.[2]	W. G. Leamon	James W. Johnson	F. E. Cannon	F. E. Cannon	P. R. MacHale
Regal Oil & Refining Co., Ltd., Ardern Block, Calgary[3]	R. J. Hutchings	F. J. Huff*	F. R. Carey	F. R. Carey	F. R. Carey

*General manager.

†Alberta Refining Co. has shut down its 350-bbl. daily capacity plant at Edmonton. Invincible Oils, Ltd., has shut down its 100-bbl. daily capacity plant at Wainwright.

[1]Maple Leaf Oil & Refining Co., Ltd.: D. E. Hageman, general manager; K. R. Jallings, chief chemist.

BRITISH COLUMBIA†

Imperial Oil Co., Ltd., 56 Church St., Toronto, Ontario	See Ontario	See Ontario	See Ontario	See Ontario	See Ontario
Home Oil Distributors, Ltd., 555 Burrard St., Vancouver[1]	W. J. Blake-Wilson	Austin C. Taylor	W. W. Boultbee	W. W. Boultbee	S. F. Barbaur
Seaboard Oil & Refining Co., Ltd., 422 Standard Bldg., Vancouver	David B. Boyd*	Edwin R. Sheldon	Charles E. Brown	Charles E. Brown	

*General manager.

†Union Oil Co. of Canada shut down its 1,500,661 daily capacity plant at Port Moody.

MANITOBA

North Star Oil, Ltd., Scott Block, Winnipeg	C. W. Fillmore	T. N. Clayton*	S. T. McGinn	T. N. Clayton	

*General manager.

NOVA SCOTIA

Imperial Oil, Ltd., 56 Church St., Toronto, Ontario	See Ontario	See Ontario	See Ontario	See Ontario	See Ontario

ONTARIO

Imperial Oil, Ltd., 56 Church St., Toronto[1]	C. O. Stillman	H. G. Smith	F. E. Holbrook	F. E. Holbrook	L. E. Bury
Canadian Oil Companies, Ltd., 2-12 Strachan Ave., Toronto[2]	F. B. Fretter	F. H. Littlefield*	H. F. Hoecker	F. C. West	G. S. Middaugh
British Oil Co., Ltd., The, Royal Bank Bldg., Toronto[3]	A. L. Ellsworth	C. L. Suhr	P. W. Binns	J. C. Miller	
McColl-Frontenac Oil Co., Ltd., 307 Royal Bank Bldg., Montreal, Quebec[4]	John Irwin	J. A. Wales	Fred Hunt	Fred Hunt	B. F. Stanton

*General manager.

[1]Imperial Oil, Ltd.: A. M. McQueen, F. J. Wolfe, vice presidents; E. R. Ewing, general manager of refineries and director; L. C. McCloskey, assistant general manager of refineries; Dr. R. K. Stratford, chief research chemist; Gordon McIntyre, chief chemist. Assistant refinery superintendents—J. J. Hanna, Calgary; Clifford Moore, Regina; G. L. Stewart, Sarnia; J. L. McCarthy, Montreal; R. D. King, Halifax.

QUEBEC

Imperial Oil, Ltd., 56 Church St., Toronto, Ontario	See Ontario	See Ontario	See Ontario	See Ontario	See Ontario
McColl-Frontenac Oil Co., Ltd., 307 Royal Bank Bldg, Montreal	See Ontario	See Ontario	See Ontario	See Ontario	See Ontario

SASKATCHEWAN

Imperial Oil, Ltd., 56 Church St., Toronto, Ontario	See Ontario	See Ontario	See Ontario	See Ontario	See Ontario

Survey of Operating Refineries in United States

Personnel and Plant Data

TEXAS (Continued)

Name of company—	Plant location	Daily crude capacity	Type plant	Daily crack. capacity	Type cracking unit	Plant superintendent	Chief engineer	Sales Managers— Tank car	Sales Managers— Bulk and service station
Tonkawa Pet. Corp.	Pyote	5,000	S	....		H. J. Toups		W. L. Snoddy	W. L. Snoddy
Waggoner Refining Co.	Electra	4,000	S	....		J. C. Hinds			
Wickett Refining Co.	Wickett	2,000	S	....		O. H. Berryman		J. B. Saunders	
H. F. Wilcox Oil & Gas Co.	Pampa	3,500	S	....		John A. Oakes	W. R. Bingham	A. M. Ballard	A. M. Ballard

managers: Beaumont, H. H. Ziller, E. E. Swope; Fort Worth, C. J. Lockwood. E. E. Plumly is manager of the refinery department. Assistant refinery superintendents at the Beaumont plant are John Newton and Guy Plumly. W. W. Leath is chief chemist.

[11]Misko Refineries, Inc.: Kent W. Bartlett, vice president.

[15]Panhandle Refining Co.: W. D. Brookover, vice president; assistant refinery superintendent, O. B. Males; V. U. Cloer, chief chemist.

[16]Pasotex Petroleum Co.: R. W. Hanna, A. S. Russell, vice presidents.

[17]Petroleum Conversion Corp.: Walter M. McFarland, vice president.

[18]Petroleum Refractionating Corp.: Albert Finston, vice president.

[19]Richardson Refining Co.: J. C. Moore, assistant refinery superintendent; W. C. Dunn, chief chemist.

[20]Simms Oil Co.: W. L. Todd, vice president; H. L. Kerr, chief chemist; H. W. Coleman, assistant tank car salesmanager.

[21]Stone Oil Co.: Operating old plant purchased January 1, from Terminal Oil & Refining Co., by Atlantic Pipe Line Co., under lease.

[22]Taylor Refining Co.: Robert T. Piner, E. L. Chapman, vice presidents; Lester Landman, chief chemist.

[23]The Texas Company: T. J. Donoghue, F. T. Manley, G. L. Noble, R. Ogarrio, T. Rieber, W. S. S. Rodgers, vice presidents; L. R. Holmes, manager of refinery department; F. P. Dodge, general superintendent of refineries.

[24]Texas Pacific Coal & Oil Co.: O. E. Mitchel, vice president; C. A. Barrew, assistant refinery superintendent at Fort Worth; E. W. Tublin, chief chemist.

[25]Wickett Refining Co.: George Buckner, general manager.

[26]Golden West Oil Co.: Plant located 10 miles south of Hondo. Material on ground for additional 250-bbl. capacity. James Ryan, assistant refinery superintendent.

[27]Grayburg Oil Co.: Cracking plant shut down.

UTAH

Diamond Oil Co.	Virgin City	500	S	....		J. W. Musser	J. W. Musser		
Utah Oil Refining Co.	Salt Lake City	6,500	Comp.	7,900	Modified Burton Holmes-Manley	E. S. Holt	R. G. Clark	M. J. Greenwood	M. J. Greenwood

VIRGINIA

The Texas Company	Norfolk	1,500	A	....		V. B. Pevoto	See Texas	See Texas	See Texas

WEST VIRGINIA

Elk Refining Co.	Falling Rock	2,000	S-L	....		W. A. Myers	Elmer Anderson	W. Walter McKee	John W. Wright
Ohio Valley Refining Co.	St. Marys	2,000	L-C	750	Dubbs	J. B. Northrop		A. M. Kiester	H. G. Triplett
Pure Oil Co.	Cabin Creek	3,500	S-C	1,500	Gyro	J. R. Palmer	See Oklahoma	See Oklahoma	See Oklahoma
Standard Oil Co. of New Jersey	Parkersburg	5,000	A-C	9,131	Tu'e & Tank	E. A. Rudigier	See New Jersey	See New Jersey	See New Jersey
Tri-State Refining Co.	Kenova	2,000	S-C	1,800	Jenkins	W. D. Manz	W. D. Manz	W. H. Seltzer	I. C. Jessie

[2]Ohio Valley Refining Co.: L. D. Shreves, assistant refinery superintendent; G. R. Dye, chief chemist.

[3]Pure Oil Co.: J. McGraw, assistant refinery superintendent.

WYOMING

Continental Oil Co.	Glenrock	4,000	S	....		A. N. Hovlid	See Oklahoma	See Oklahoma	See Oklahoma
Egaso Operating Co.	Osage	750	S-C	1,000	Cross	A. T. Lesley			
Gillette Ref. Co.	Gillette	150	S	....		John Selby			
Hole's Pedro Refinery	Pedro	500	L	....		W. B. Channel	W. B. Channel	B. V. Hole	B. V. Hole
Midwest Refining Co.	Casper	50,000	Comp.	30,000	Burton	J. E. Rouse	P. G. Weidner	H. G. Naylor	H. G. Naylor
Midwest Refining Co.	Laramie	3,000	S-C	4,500	Burton	J. F. Cullen	See above	See above	See above
Midwest Refining Co.	Greybull	10,000	S-A-C	15,000	Burton	B. L. Warren	See above	See above	See above
Producers & Refiners	Parco	10,000	S-L-C	4,000	Dubbs	L. M. Johnston	J. A. Sartori	A. T. Smith	B. L. Meece
The Texas Company	Casper	7,000	Comp.	7,500	Holmes-Manley Pressure Coke	L. F. J. Wilking	See Texas	See Texas	See Texas
The Texas Company	Labarge	300	S	....		G. D. Evans	See Texas	See Texas	See Texas
The Texas Company	Cody	3,000	Comp.	1,500	Holmes-Manley	P. Beall	See Texas	See Texas	See Texas
White Eagle Oil Corp.	Casper	4,500	S-A-C	4,500	Coil, Holmes-Manley, Jenkins	J. W. Glass		H. L. McReynolds	C. L. Jolliffe
Wyoming Gas & Oil Co.	Osage	100	S	....		C. F. Martens		W. K. Poulson	

manager and A. E. Thompson is superintendent of Casper plants Nos. 1 and 2; R. E. Beard is superintendent and R. E. Wood is assistant superintendent at Casper plant No. 3. D. L. Warren is superintendent at plants Nos. 1 and 2, at Greybull; J. F. Cullen is superintendent at the Laramie plants Nos. 1 and 2, and L. E. Chamberlain is superintendent of the Glenrock plant. H. C. Bretschneider and George H. Jaques, vice presidents; S. K. Loy, chief chemist.

SURVEY OF OPERATING REFINERIES IN CANADA

ALBERTA†

Imperial Oil, Ltd.	Calgary	5,000	S	....		C. M. Moore	T. Montgomery	J. McNeil	A. E. Halverson
Maple Leaf Oil & Ref. Co., Ltd.	Coutts	5,000	S	....		L. S. Sweeney		C. C. Peake	C. C. Peake
Northwest Stellarene Co., Inc.	Coutts	1,500	C	1,500	Leamon	Hayward Gatherings	Ralph M. Parsons	James W. Johnson	James W. Johnson
Regal Oil & Refining Co., Ltd.	Calgary	2,000	S	....		J. A. Milliff			

[2]Northwest Stellarene Co., Inc.: R. J. Lindsay, vice president; W. G. Eley, chief chemist. Construction of this plant involved the modernization of the old Beaver refinery.

[3]Regal Oil & Refining Co., Ltd.: Eric L. Harvie, vice president.

BRITISH COLUMBIA†

Imperial Oil Co., Ltd.	Ioco	16,000	S-C	....	Tube & Tank	A. D. Grant	See Ontario	See Ontario	See Ontario
Home Oil Distributors, Ltd.	N. Vancouver	1,000	S	....		G. Kobrow		L. J. Martin	F. E. MacArthur
Seaboard Oil & Ref. Co., Ltd.	Vancouver	4,000	S	....		Frank A. Milliff			

[1]Home Oil Distributors, Ltd.: H. G. Fowler, general manager; James Elsey, assistant refinery superintendent; A. Reese, chief chemist.

MANITOBA

North Star Oil, Ltd.	St. Boniface	300	S	....		T. N. Clayton			

NOVA SCOTIA

Imperial Oil, Ltd.	Halifax	17,000	Comp.	....	Tube & Tank	R. L. Dunsmore	See Ontario	See Ontario	See Ontario

ONTARIO

Imperial Oil, Ltd.	Sarnia	22,000	Comp.	....	Tube & Tank	Charles B. Leaver	T. Montgomery	J. McNeil	A. E. Halverson
Canadian Oil Companies, Ltd.	Petrolia	1,500	Comp.	....		C. A. Hale		F. C. West	F. C. West
British Oil Co., Ltd.	Toronto	5,000				L. E. Woolley			
McColl-Frontenac Oil Co., Ltd.	Toronto	10,000	S-C	4,000	Jenkins & Gyro	C. B. W. Anderson	R. C. Kinzer		

[2]Canadian Oil Companies, Ltd.: E. A. Smith, chief chemist.

[3]British Oil Co., Ltd.: S. R. Parsons, chairman of the board.

[4]McColl-Frontenac Oil Co., Ltd.: J. M. Pritchard, P. A. Thomson, S. S. Griffiths, H. H. Bradburn, vice presidents; G. R. Taylor, chief chemist; assistant refinery superintendent, L. W. McClaran, Montreal, Quebec.

QUEBEC

Imperial Oil, Ltd.	Montreal	30,000	Comp.	....	Tube & Tank	F. C. Mechin	See Ontario	See Ontario	See Ontario
McColl-Frontenac Oil Co., Ltd.	Montreal	8,000	S-C	4,000	Jenkins & Gyro	J. D. Brown	See Ontario		

SASKATCHEWAN

Imperial Oil, Ltd.	Regina	7,200	Comp.	....		George Leach	See Ontario	See Ontario	See Ontario

Space and heavy foundations are no longer a requirement for heavy duty station service if Byron Jackson Multiplex Pumps are used. The proof of this is furnished in the above picture.

The small Byron Jackson Multiplex in the foreground requires only a minimum of space and yet it pumps fifty percent more fluid than the obsolete piece of equipment in the background. The proven economy and efficiency of this pump, coupled with established dependability, have revolutionized pumping practices in municipalities, the oil fields and industries at large.

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BYRON JACKSON

CENTRIFUGAL PUMPS FOR EVERY SERVICE

Shut Down Refineries in United States

Few Additional Plants Added to List. Several Which Had Been Inactive for Five or More Years Dismantled

ARIZONA

Company, plant location—	Daily cap. (bbls.)	Type of plant
Tucson Oil & Refining Co., Tucson	500	S

ARKANSAS

Home Refining Co., Camden	500	S
E. M. Tulle Refinery, El Dorado	1,000	S
Total	1,500	

CALIFORNIA

Associated Oil Co., Amorco	10,000	S
Crescent Refining & Oil Co., Los Angeles	6,000	S
Delaney Producing & Refining Co., Long Beach	3,000	S
East-West Refining Co., Los Angeles	1,000	S
Eureka Petroleum Corp., Los Angeles	5,000	S
General Petroleum Corp. of California, Lebec	12,000	S
Hart Dearing Refining Co., Fellows	3,000	S
Perfection Refining Co., Hynes	1,000	S
Producers Refining Co., Kern River	500	L
Richfield Oil Co., Bakersfield	2,000	S
Richfield Oil Co., Fellows	3,000	S
Richfield Oil Co., Los Angeles	4,000	S
Sentinel Oil Co., Los Angeles	1,000	S
The Texas Company, Coalinga	1,000	S
Wilshire Oil Co., Fellows	2,500	S
Total	55,000	

ILLINOIS

Barber Asphalt Co., Madison	700	A
Interocean Refining Co., McCook	5,000	S&L
Total	5,700	

INDIANA

Portland Oil & Refining Co., Portland	600	S&C
Interstate Gasoline Co., East Chicago	2,500	S&C
Total	3,100	

IOWA

Omaha Refining Co., East Omaha	1,500	S&C

KANSAS

Commonwealth Oil Refining Co., Moran	1,000	S
Grant Oil Co., Augusta	2,500	S&C
Hutchinson Oil Refining Co., Hutchinson	2,500	S
Miller Petroleum Co., Humboldt	2,500	S&C
Red Bird Refining Co., Fredonia	200	S
Richardson Refining Co., Eldorado	1,500	S
Total	10,200	

KENTUCKY

Central Producing & Refining Co., Bowling Green	600	S
Great Southern Refining Co., Lexington	2,500	S&L
Neha Refining Co., Lexington	800	S
Total	3,900	

LOUISIANA

Alexandria Refining Co., Alexandria	600	S&C
Crystal Oil Refining Co., Shreveport	10,000	S&C
Great Southern Refining Co., Ardis	2,000	S
Louisiana Oil Refining Corp., Bossier City	13,000	A
Red River Refining Co., Crichton	1,800	S
Sinclair Refining Co. of Louisiana, Meraux	30,000	A
Southern Oil & Refining Co., Oil City	1,500	S
Total	58,900	

MARYLAND

Interocean Refining Co., Baltimore	7,000	S&C

MICHIGAN

Standard Oil Co. of Indiana, Zilwaukee	1,500	S

MISSOURI

Interstate Rubber Producing Co., Kansas City	3,000	S&C

MONTANA

American Refining Co., Great Falls	1,000	S
Montana Refining Co., Billings	750	S
Round Up Oil & Refining Co., Butte	200	S
Total	1,950	

NEW MEXICO

Company, plant location—	Daily cap. (bbls.)	Type of plant
Bloomfield Oil & Gas Co., Bloomfield	300	S
Colfax Refining Co., Colfax	500	S
Sullivan Refineries, Inc., Dayton	1,550	S
Total	2,350	

OKLAHOMA

Canfield Refining Co., Yale	400	S&L
Carter Oil Co., Cartoco	5,000	S
Chestnut & Smith Corp., Sand Springs	5,000	S
Electrol Refining Co., Oklahoma City	500	S
Gilmer Oil Co., Ringling	1,000	S
Inland Refining Co., Cushing	1,000	S
Interocean Refining Co., Bristow	4,000	S
Newkirk Oil & Refining Co., Newkirk	2,000	S
Oil State Refining Co., Enid	1,800	S
Pauline Refining Co., Hampton	1,200	S
Producers & Refiners Corp., Blackwell	3,000	S
Red Seal Refining Corp., Oklahoma City	2,000	S
Remington Oil Co., Wewoka	2,000	S
Santa Fe Oil & Refining Co., Ardmore	5,000	S
Sayre Oil & Refining Co., Sayre	500	S
Sinclair Refining Co., Muskogee	1,500	S
Superior Oil Corp., Grandfield	2,000	S
Walter Refining Co., Walters	2,500	S
Total	40,400	

OHIO

Akron Oil Refining Co., Akron	750	S
Rajah Oil & Refining Co., Youngstown	500	S
Total	1,250	

PENNSYLVANIA

Beaver Refining Co., Washington	200	S
Chippewa Oil Co., West Bridgewater	300	L
Conewango Refining Co., Langdale Switch	2,000	S
Island Petroleum Co., Neville	1,000	L
North Penn Refining Co., Tiona	500	S&L
Titusville Oil Works, Titusville	1,000	S-L-C
Warren Refining Co., Russell	300	S&L
Total	5,300	

TEXAS

American Oil Co., Pioneer	1,200	S
Bridgeport Refining Co., Bridgeport	800	S
Crystal Oil Corp., Burkburnett	1,000	S
De Leon Pipe Line & Refining Co., De Leon	1,500	S
Deer Oil Corp., Angus	4,500	S
Deer Oil Corp., Minerva	2,500	S
Four States Refining Co., Texarkana	700	S
Freeport Asphalt Co., Freeport	5,000	S&A
Hagaman Refinery Corp., Ranger	2,000	S
Mexia Oil & Refining Co., Mexia	500	S
National Refining Co. of Texas, Greenville	2,000	S
Paterson Oil Co., Brownwood	1,000	S
Petroleum Corp., Electra	1,500	S
Sinclair Refining Co., Fort Worth	8,000	S
Sinclair Refining Co., Texas City	5,000	S
Southwestern Refining Co., Sour Lake	1,000	L
South Bosque Refining Co., South Bosque	1,000	S
Swastika Refining Co., Muenster	1,000	S
Texas Oil Products Co., Waxahachie	2,500	S
Valley Refining Co., Wichita Falls	2,500	S
Waco Refining & Pipe Line Co., East Waco	2,500	S
Western Oil Corp., Wichita Falls	2,500	S
Yuba Oil Refining Co., Nacogdoches	100	S&L
Total	43,300	

TENNESSEE

Gillespie Oil Corp., Gallatin	250	S
Nashville Oil Co., Nashville	500	S
Urania Petroleum Co., Ltd.	500	S
Total	1,250	

WASHINGTON

Inland Empire Refining Co., Parkwater	500	S
Spokane Oil & Refining Co., Hillyard	1,000	S
Total	1,500	

WYOMING

Alliance Oil & Refining Co., Thermopolis	1,500	S
Lovell Refinery, Lovell	600	S
Total	2,100	

Correlate Vapor Pressure and Losses

Enables Refiner to Determine Economic Balance in the Recovery of Butane for Blending With Motor Fuel

By W. K. Lewis* and Stewart P. Coleman†[1]

SUMMARY OF CONCLUSIONS

In the following article the authors have outlined the mechanism of evaporation loss and have shown its significance in the economic control of gasoline volatility. The findings are based upon commercial scale operations and the conclusions drawn may be taken as a guide in the routine of refinery operations to effect a material savings. The authors have summarized their conclusions as follows:

1. Under conditions of storage, the partial pressure of gasoline in the vapor space of the tank corresponds at all times substantially to equilibrium with the liquid in the tank at tank temperature.

2. Evaporation losses during storage are proportional, other conditions equal, to the vapor pressure of the gasoline and to its molecular weight. The latter is ordinarily a factor that varies but little.

3. Evaporation losses in working storage vary greatly with the conditions but for given conditions are either proportional to vapor pressure or rise more rapidly than this proportionality indicates. The losses rise excessively rapidly when the pressure approaches atmospheric, but below approximately 300 millimeters are substantially proportional to vapor pressure.

4. These conclusions were checked experimentally by careful measurements in connection with the commercial handling of 60,000 bbls. of gasoline of widely differing vapor pressures.

5. It was proven experimentally that the increase in vapor pressure of a gasoline due to the incorporation of butane checks Raoult's Law within about 3 per cent.

6. These generalizations make it possible for the refiner to determine the point of economic balance in the recovery of butane for incorporation in gasoline stock from a knowledge of his present losses in handling together with other readily determinable data.

With the advent of methods[2] for analysis of light hydrocarbon mixtures in terms of their pure compohents and means of determination of true gasoline vapor pressure,[3] it is now possible to investigate quantitatively the various phases of evaporation loss and the mechanism by which it takes place.

Vapor pressure is obviously the main factor controlling in the mechanism of evaporation loss, as may be seen from the following consideration of what occurs under actual tankage storage conditions.

If, for example, we consider the vapor space of a tank partially filled with gasoline, of a vapor pressure, say of one-half of an atmosphere, obviously this vapor space cannot be filled with hydrocarbon vapor since, in order for this to exist, the vapor pressure of the gasoline in the tank would have to be equal to or greater than atmospheric pressure. According to Dalton's law, the gasoline vapor in the air-vapor mixture in the tank will be proportional to the vapor pressure of the liquid gasoline. Consequently, in this particular case the volumetric composition of the mixture in the vapor space will be half air and half hydrocarbon vapor. After a tank has had sufficient time to come to equilibrium, this condition actually exists, as may be seen from the following data from the operation of a Humble Pipe Line Co. pumping station.

At this station different grades of crude oil were constantly passing through tanks for the purpose of checking quantities received. Samples of the vapor being displaced by the incoming crude were secured and analyzed for air and per cent of hydrocarbon vapor.

Crude data—	A	B	C	D	E
Vapor pressure at 76°F. mm. Hg.	249	188	299	202	136
Oil temp. °F.	60	62	74	72	72
Oil rate, bbls./hr.	4,200	4,200	3,650	850	1,150
Gas analyses (Orsat)					
% H_2S	0.7	0.25	0.7	0.0	0.0
% O_2	16.1	16.95	12.8	15.2	17.7
Calculated Results: Vapor pressure at oil temp. mm. of Hg.	170	134	285	190	120
From Orsat analyses					
% air	77.0	81.1	61.2	72.7	84.7
% hydrocarbons	22.3	18.65	38.1	27.3	15.3
From vapor pressures					
% hydrocarbons	22.4	17.6	37.5	25.0	15.8

Following are the results of the ultimate analyses of the vent gases from crudes A and B in terms of actual hydrocarbons:

Crude—	A	B
Methane, per cent by vol.	3.03	6.06
Ethane, per cent by vol.	1.32	0.73
Propane, per cent by vol.	4.40	3.88
Iso-butane, per cent by vol.	1.56	0.75
Butane, per cent by vol.	5.07	5.42
Heavier, per cent by vol.	2.75	2.16
Air, per cent by vol.	81.87	81.00
Gasoline content, gals./1,000 cu. ft.	2.57	2.45

It is of interest to note the close correlation secured between the proportion of hydrocarbon vapor actually determined by gas analysis and that calculated from the vapor pressure of the oil at the existing tank liquid temperature. This checks the assumption made in previous investigations of this question.[4]

The above relationship is of marked practical value in predicting evaporation losses for a liquid of given vapor pressure under a known set of evaporation conditions. The above data, for example, were taken in studying losses encountered in displacing storage tanks by crude in transit through an oil pipe line station. Knowing the volume of oil passing in and out of the tanks and, consequently, the volume of vapor displaced, a consideration of the value of the various hydrocarbon constituents of the vapor demonstrated, in this particular case, that preventive means were amply justified.

Simple Relationship

These preliminary studies indicated a relationship governing evaporation losses from tankage so simple that it was deemed imperative to submit the mechanism of evaporation loss to a thorough analysis, in the hope that quantitative relationships and computation methods could be developed which would make it possible to predict with certainty the effect on evaporation of the variations in its controlling factors, particularly in the vapor pressure of the gasoline and in the methods of handling it. The first step was to determine exactly what takes place when air enters the vapor space of a gasoline tank.* It is clear that the mechanism cannot be primarily one of vapor diffusion because this is far too slow to account for the losses observed. How does the gasoline get into the gas?

Mechanism of Saturating

Visualize the emptying of a tank nearly full of gasoline. At the start the air just above the liquid is obviously saturated with gasoline vapor. This mixture is far heavier than air. Thus, for a normal gasoline, with a vapor pressure somewhat more than half an atmosphere, the air-vapor mixture has double the density of air. As the liquid level in the tank falls on pumping out, air comes in at the top of the vapor space. Since conditions in the vapor space are quiet, there will be almost perfect vapor stratification, the incoming air resting as a blanket on the saturated mixture just above the liquid, with but little mixing of the two layers.

Furthermore, so long as outside temperature is higher than vapor space temperature (average daytime conditions) this stratification will persist. The air in the top of the tank will be heated, whereas the air-vapor mixture above the surface of the liquid will be kept cool by the liquid, these differences in temperature accentuating the already existing differences in density. If, now, the tank be filled under these conditions, the gas expelled from the top will be this upper blanket of practically pure air and evaporation loss due to filling will be negligible.

Assume, however, that after the liquid has been pumped out the outside temperature becomes lower than liquid temperature (average night conditions). The vapor space loses heat through the roof and the air immediately under it becomes cool. Due to this cooling it becomes heavier and, in consequence, active convection currents develop, the air immediately under the roof falling, predominantly along the sides of the tank because these, too, are cool, and being continuously replaced by warm air rising from the middle of the vapor space. These convection currents in the air blanket sweep over and erode the vapor-air mixture lying immediately over the liquid. This causes relatively rapid mixing of the two layers so that the gas in the vapor space soon becomes substantially homogeneous, both thermally and in gasoline content, at the temperature of the liquid. However, when this state is reached, despite further loss of heat from the tank roof, convection slows up and nearly ceases. This is because of the fact that gasoline condenses on the under surface of the cold roof from the saturated vapor-air mixture immediately in contact with it. This reduces the gasoline content of this upper layer of air and thereby lowers its density. Furthermore, this lowering in density due to condensation is, under ordinary conditions, far greater than the rise in density due to drop in temperature. As an example, at 80° F. a gasoline with a vapor pressure of one-third atmosphere will show a fractional change of pressure per degree of about 0.02 (2 per cent). Its vapor will have a molecular weight of about 80. Hence with drop in temperature, its density falls roughly 0.6 per cent degree, whereas, due to temperature effect alone without condensation, it would rise a little under 0.2 per cent per degree. The formula is

$$\frac{d\rho}{\rho dT} = \frac{P(M-29)(d\text{ in }P/d\text{ in }T-1)-29\pi}{T[MP+29(\pi-P)]}$$

Where

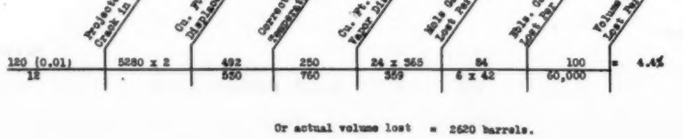
ρ = density in lbs. per cu. ft.
P = vapor pressure of gasoline in mm.
M = molecular wt. of gasoline vapors.
π = total atmospheric pressure in mm.
T = absolute temperature.
(d is calculus symbol for "differential.")

Consequently, the layer of gas just below the roof of the tank becomes and remains lighter than the main body of the gas below so that convection ceases. While cooling of the sides of the vapor space tends to cause reversed convection currents, this effect appears to be slight. Consequently, the bulk of the contents of the vapor space remains unchanged in temperature and composition, in equilibrium with the body of liquid in the tank.

At first thought, one might conclude that this vapor will be in equilibrium only with the surface layer of the liquid. However, it must be remembered that this vapor mixture in the top of the tank was formed by evaporation of liquid from the surface. This evaporation cools the liquid on the surface, due to the heat effect of vaporization. Furthermore, the low boiling, low density hydrocarbons in the liquid evaporate in larger proportion than the higher boiling, higher density components. Therefore, the density of the liquid on the surface is increased by evaporation due to the cumulative effect of both these factors. Consequently, this heavy surface layer falls by convection, to be replaced by rising currents of gasoline from the main body of the liquid in the tank. In other words, during the period of evaporation, when vapor space temperatures are lower than liquid temperatures, convection currents set up and tend to establish and maintain conditions of uniformity, both throughout the vapor space and the liquid in the tank.

During such a period of low outside temperatures, it is obvious that there is

(Continued on Page 220)



Or actual volume lost = 2620 barrels.

*Department of Chemical Engineering, Massachusetts Institute of Technology.

†Director, Technical Service and Development Department, Humble Oil & Refining Co.

[1]Taken from material present to the Massachusetts Institute of Technology by Stewart P. Coleman in the partial fulfillment of the requirements for the degree of Doctor of Science.

[2]"Method of Analysis of Natural Gasoline" by Walter J. Podbielniak; The Oil and Gas Journal, January 17, 1929.

[3]"Rectification of Gasoline Fractions" by H. D. Wilde, Jr., Brian Mead and Stewart P. Coleman; The Oil and Gas Journal, March 7, 1929.

[4]"Prevention of Evaporation Losses from Gasoline Storage Tanks" by R. E. Wilson, H. V. Atwell, E. P. Brown and G. W. Chenicek; Industrial and Engineering Chemistry, October, 1925.

Dyes to Reduce Loss in Acid Treatment

Method Eliminates Treating Process Which Lessens Anti-knock Value, and Gasoline Can Be Made Marketable Cheaper

By Gustav Egloff, J. C. Morrell and Paul Truesdell
Universal Oil Products Co.

Color charms the human eye and coaxes pennies out of pocketbooks. We all remember the red lemonade at the circus in our childhood days. The red lemonade did not really taste any better than the lemon-colored, but it seemed more tempting and it sold better.

So it is with colored gasoline—red, blue, green, every color of the rainbow. Gasoline may be dyed almost any color, but dyeing it does not affect its quality. Gasoline is usually artificially colored for one of several reasons:

1. To give it a distinctive appearance so that it can be readily identified and thus promote sales.

2. To mask a yellowish or brownish tinge and hence improve the appearance of the gasoline in bowls of visible pumps.

3. To "neutralize" colored compounds, when they are present only in small amount, in order to give the gasoline the appearance of water whiteness. In such cases only enough dye is used to overcome the color-forming substances in the gasoline, but not enough to give the gasoline the distinctive color of the dye. This will be discussed later.

4. To cut the cost of refining, prevent loss of gasoline and preserve its knock rating.

It is impossible to say just how much colored gasoline sold today is dyed in order to give it a distinctive color, and how much is dyed to conceal a yellowish tinge. Neither can one tell exactly to what extent the coloring of gasoline helps sales. It is probable, however, that over 25 per cent of the motor fuel sold in the United States today is artificially colored.

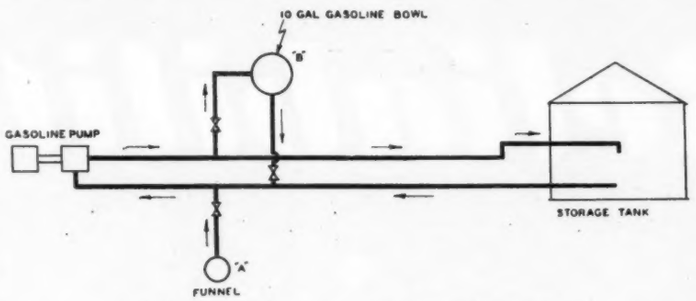
It is estimated that at least $10,000,000 a year could be saved by American refiners if they used dyes to the fullest possible extent to please the color sense of the motorist, instead of relying entirely upon sulphuric acid treatment to make a water white product.

Not many years ago, all the gasoline made was produced by straight distillation of crude oil. This gasoline had a sparkling clearness, like spring water, and it was taken as a matter of course that gasoline should be water white. Difficulties in making a water white product arose when cracking became a factor in the refining picture. As the percentage of cracked gasoline increased, with a corresponding decrease in the percentage of straightrun motor fuel, color troubles multiplied. Whereas the original straightrun gasoline was water white, cracked gasoline, in general, has a yellow cast, unless great care is exercised in refining it.

The refiners' color troubles arose from the fact that, although they were making a different kind of gasoline, the motorists (educated to it by sales engineers, refiners and jobbers) generally insisted on the same water white color they had been used to in the old gasoline. But treating cracked gasoline with sulphuric acid to make it water white is expensive.

Then someone hatched the idea that one way to escape the trouble and expense of treating gasoline for color was to dye it some distinctive hue instead.

(Continued on Page 205)



Sketch of apparatus used in mixing dye with gasoline.

TABLE NO. 1.

Dye name—	Benzol		Mid-Continent straightrun gasoline			Mid-Continent cracked gasoline		
	Solubility	Color	Solubility	Color	Fading time	Solubility	Color	Fading time
REDS:								
1. Oil Red No. 1 Conc.	Sol.	Red	Sol.	Deep red	+56	Sol.	Red	+85
2. Oil Red L. A.	Sol.	Red	Sol.	Red		Sol.	Red	+50
3. Oil Red No. 322	Sol.	Red	Sol.	Red	+56	Sol.	Red	+50
4. Oil Red 3B	Sol.	Red	Sol.	Red	+56	Sol.	Red	+50
5. Oil Red No. 13,044	Sol.	Red	Sol.	Deep red	+56	Sol.	Red	+50
6. Oil Scarlet F	Sol.	Red	Slightly sol.	Red	Settles out slightly	Sol.	Red	+50
7. Oil Red BB	Sol.	Red	Sol.	Red	+56	Sol.	Red	+50
8. Alizarin Rubinole R Base	Sol.	Red	Sol.	Pink	+56	Sol.	Pink	+50
9. Oil Red No. 22,094	Sol.	Red	Sol.	Red	+56	Sol.	Red	+50
10. Oil Red No. 282	Sol.	Red	Sol.	Red		Sol.	Red	+50
11. Oil Red Y292	Sol.	Red	Sol.	Red	+56	Sol.	Red	+50
12. Oil Red G RO	Sol.	Red	Sol.	Red	+56	Sol.	Red	+50
13. Oil Red	Sol.	Red				Sol.	Red	+50
14. Oil Red O	Sol.	Red	Sol.	Red	+56	Sol.	Red	+50
15. Oil Red AB	Sol.	Red	Sol.	Deep red	+56	Sol.	Red	+50
16. Oil Red	Sol.	Red	Slightly sol.	Red	Settles out overnight	Sol.	Red	+50
17. Oil Scarlet	Sol.	Red	Sol.	Orange	+56	Sol.	Orange	+50
18. Gaso Red No. 2,744	Sol.	Red	Sol.	Red	Faded in 49 hrs.	Sol.	Red	Faded in 44 hrs.
BLUES:								
1. Oil Blue A. E.	Sol	Blue	Sol.	Green	Faded green, 56 hrs.	Sol.	Brown	24
2. Oil Imported Blue	Sol.	Blue	Sol.	Blue	+50	Sol.	Blue	+50
3. Oil Blue No. 463	Sol.	Green	Insol.			Insol.		
4. Oil Blue No. 462	Sol.	Blue	Insol.			Insol.		
5. Oil Blue No. 451	Sol.	Blue	Insol.			Insol.		
6. Alizarin Blue AS	Sol.	Blue	Sol.	Blue	+56	Sol.	Blue	+50
7. Oil Blue B No. 5,199	Sol.	Red	Slightly sol.	Faint wine	Pptd. in 6 hrs.	Slightly sol.	Purple	21
8. Oil Blue MG	Sol.	Blue	Sol.	Blue	+58	Sol.	Blue	+50
9. Gaso Blue No. 2,743	Sol.	Blue	Sol.	Blue	Faded in 44 hrs.	Sol.	Blue	Faded to green in 44 hrs.
10. Oil Blue H	Sol.	Blue	Insol.			Insol.		
11. Oil Blue B	Sol.	Blue	Insol.			Insol.		
12. Victoria Blue B Base	Sol.	Blue	Insol.			Insol.		
13. Victoria Blue B Base	Sol.	Blue	Insol.			Insol.		
14. Oil Blue Lumps	Sol.	Blue	Insol.			Insol.		
15. Oil Blue B	Sol.	Blue	Insol.			Insol.		
16. Spirit Blue Ex. Conc.	Sol.	Blue	Insol.			Insol.		
17. Victoria Blue B	Sol.	Blue	Insol.			Insol.		
18. Oil Blue No. 184	Sol.	Blue	Insol.			Insol.		
19. Oil Blue No. 1,045	Sol.	Blue	Insol.			Insol.		
20. Oil Blue No. 1,050	Sol.	Blue	Insol.			Insol.		
YELLOWS:								
1. Oil Yellow AX	Sol.	Yellow	Sol.	Yellow	+56	Sol.	Yellow	+50
2. Oil Yellow No. 21	Sol.	Yellow	Sol.	Yellow	+56	Sol.	Yellow	+50
3. Oil Yellow No. 2	Sol.	Yellow	Sol.	Yellow	+56	Sol.	Yellow	+50
4. Oil Yellow	Sol.	Yellow	Sol.	Yellow	+56	Sol.	Yellow	+50
5. Oil Yellow GB	Sol.	Orange	Sol.	Yellow	+56	Sol.	Orange	+50
6. Oil Yellow T	Sol.	Yellow	Sol.	Yellow	+56	Sol.	Yellow	+50
7. Oil Yellow No. 1	Sol.	Yellow	Sol.	Yellow	+56	Sol.	Yellow	+50
8. Oil Yellow AG	Sol.	Reddish yellow	Sol.	Yellow	+56	Sol.	Yellow	+50
9. Oil Yellow	Sol.	Yellow	Sol.	Yellow	+56	Sol.	Yellow	+50
10. Oil Yellow No. 21	Sol.	Brown	Sol.	Orange	+56	Sol.	Yellow	+85
11. Oil Yellow No. 2,681	Sol.	Yellow	Insol.			Sol.	Yellow	Faded in 25 hrs.
GREENS:								
1. Oil Green AS	Sol.	Brown	Sol.	Brown	Pptd. in 56 hrs.	Sol.	Brown	Pptd. in 27 hrs.
2. Oil Imported Green	Sol.	Green	Sol.	Blue	+56	Sol.	Green	+50
3. Oil Green No. 422	Sol.	Green	Sol.	Orange	Pptd. in 44 hrs.	Sol.	Yellow	+85
4. Oil Green C	Sol.	Brown	Insol.			Slightly sol.	Brown	Faded in 21 hrs.
5. Alizarin Cycanine Green—3 G	Sol.	Green	Sol.	Green	+56	Sol.	Green	+50
6. Oil Green D3,180	Sol.	Yellowish green	Sol.	Yellowish green	+58	Sol.	Green	+50
7. Oil Green S	Sol.	Orange	Sol.	Orange		Sol.	Orange	+77
8. Gaso Green No. 2,737	Sol.	Green	Sol.	Green	+53	Sol.	Green	+53
ORANGE:								
1. Oil Orange No. 30	Sol.	Yellow	Sol.	Orange	+56	Sol.	Orange	+50
2. Oil Orange x Conc.	Sol.	Orange	Sol.	Orange	+56	Sol.	Orange	+50
3. Oil Orange	Sol.	Yellow	Sol.	Orange	+56	Sol.	Orange	+50
4. Oil Orange Base	Insol.		Sol.	Yellow	+56	Sol.	Yellow	Pptd. in 25 hrs.
5. Oil Orange No. 507	Sol.	Dark yellow	Sol.	Pale yellow	Faded in 10 hrs.	Insol.		
6. Oil Orange No. 21	Sol.	Brown	Sol.	Orange	+56	Sol.	Orange	
7. Oil Orange AJ	Sol.	Yellowish	Sol.	Red	+56	Sol.	Orange	+50
8. Gaso Orange No. 2,735	Sol.	Orange	Sol.	Orange	Faded in 44 hrs.	Sol.	Orange	Faded in 44 hrs.
MISCELLANEOUS:								
1. Oil Black B	Sol.	Brown	Insol.			Slightly sol.	Gray	Pptd. overnight
2. Oil Jet Black	Insol.		Insol.			Slightly sol.	Brown	Pptd. in 21 hrs.
3. Oil Blue Black	Sol.	Blue	Insol.			Insol.		
4. Oil Brown No. 18,248	Sol.	Red	Sol.	Red	+56	Sol.	Deep red	+50
5. Oil Brown B-10,858	Sol.	Red	Sol.	Deep red	+56	Sol.	Red	+50
6. Gaso Purple	Sol.	Purple	Sol.	Purple	Faded in 44 hrs.	Sol.	Purple	Faded in 44 hrs.
7. Methyl Violet Base	Sol.	Purple	Insol.			Insol.		
8. Oil Violet S	Sol.	Purple	Insol.			Insol.		

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NEW YORK DALLAS TULSA LOS ANGELES

Hydrogenation and Cracking of Oils

Two Operations Closely Related. Quality of Raw Material and Products Desired Directly Reflected in Operating Procedure

By Ralph H. McKee and A. Szayna
Columbia University*

Hydrogenation of oils, as an additional method of making motor fuel is attracting much attention at this time. The process is due to Dr. F. Bergius, who shortly before the great war, applied the process of hydrogenation to the making of oil products from coal. We should remember not only that Doctor Bergius was the originator of the process which goes by the name of "Berginization" but also that the developments until lately have been largely under his capable scientific and technical direction.

During the war the need of motor fuel in Germany and afterward the desire of that country to be as independent as possible of the necessity of importing gasoline and other petroleum products greatly stimulated the development of this process. At present one plant in Germany is producing considerable motor fuel from brown coal tar, a material available there in large quantity. In the United States one small commercial plant is beginning operation on petroleum oils at Bayway, N. J., and two others are under construction at Baton Rouge, La., and Baytown, Tex.

Theory of Process

The process of Berginization of oils is carried out at a high temperature and pressure. In the operation we distinguish two main reactions. They are the hydrogenation proper and the breaking of heavy hydrocarbon molecules into smaller molecules, known in the petroleum industry as "cracking." In treating heavy petroleums there is apparently first a breaking of the large hydrocarbon molecules and simultaneous addition of hydrogen at the points of cleavage. This form of Berginization does not require catalysts. On the other hand, when using such material as coal tar which is rich in phenols and condensed aromatic hydrocarbons, it is generally necessary to use catalysts to facilitate the action of the high temperature and hydrogen pressure.

When animal and vegetable unsaturated oils (or naphthalenes and similar compounds) are hydrogenated, the purpose is to make saturated oils by adding hydrogen at the double linkages present in the original material. The same is true when hydrogenation is applied for the improving of the grade of lubricating oil. This process is carried out at relatively low temperatures with catalysts such as finely divided nickel. On the other hand, the purpose of true Berginization is to produce low boiling hydrocarbons which will be suitable for motor fuels. This result is obtained by cracking the large molecules of heavy hydrocarbons to produce the light hydrocarbons with small molecules, suitable for motor fuel with simultaneous hydrogenation at the broken linkages. The factors governing the reactions in Berginization are the same as in ordinary oil cracking, that is, time and temperature. Pressure is important as it influences temperature and also facilitates hydrogenation.

Effective Pressure

In Berginization, the effective pressure is not only the total observed pressure in the system but equally the partial pressure of the hydrogen present. High partial pressure of hydrogen, by increasing the rate of reaction between the nascent hydrocarbon radicals and the hydrogen, will prevent the occurrence of the harmful phenomenon of polymerization[1 10] with its attendant formation of condensed compounds poor in hydrogen and with asphalt and coke as the end products. This hydrogenation of the free radicals is facilitated by (1) the high temperature which greatly increases the already high speed of the light hydrogen molecules and simultaneously loosens the bonds between the hydrogen atoms in a hydrogen molecule; (2) the high total pressure which controls the distance between the molecules as thereby there is a greater number of contacts between the radicals and hydrogen molecules; (3) the high partial pressure of the hydrogen gas so that there are very many meetings of radicals with hydrogen molecules as compared with the few meetings of radicals with radicals which would lead to polymerization with formation of asphalt-like bodies.

Use of Catalysts

On the other hand, it has been shown that unsaturated hydrocarbons in the initial petroleum are primarily polymerized and not hydrogenated except by the use of catalysts as activating factors. Thus the decision to use catalysts depends upon the character of the initial material and the purpose for which the hydrogenation is carried out. To get heavy lubricating or trasformer oils from materials rich in aromatic compounds or containing unsaturated hydrocarbons, we must preserve so far as possible the original carbon chains but change aromatics to naphthenes by hydrogenation. This requires the employment of catalysts as well as maintainence of proper physical conditions such as temperature, hydrogen operating pressure, etc.

However, if our purpose is to produce motor fuels, high hydrogen pressure is used to prevent polymerization of products during the cracking process and thereby increase the gasoline yield. Though we are not interested in saturating the unsaturated compounds in the initial material nor in hydrogenating the aromatic compounds yet by such hydrogenation, the gasoline consists largely of saturated hydrocarbons and will knock badly in the motor.

Aluminum chloride, ferric chloride, and zinc chloride have been used as catalysts in cracking to bring about an attack on particular linkages in the molecule, that is, to cut off butane molecules from the long chains[2 5 11]. The ideal catalyst would attack a desired linkage, say the middle one, of a chain. We know of no such catalyst.

Petroleum heavy oils consist of varying amounts of different types of hydrocarbons such as paraffins, naphthenes, aromatics and mixed types such as cyclic hydrocarbons with paraffinic side chains. These paraffinic chains whether branched or straight may be either saturated or unsaturated. By simple cracking of one of the mixed hydrocarbons, for example, an aromatic hydrocarbon with long branched chain, we may obtain an aromatic hydrocarbon and an aliphatic unsaturated product, which may polymerize. Using hydrogen under high pressure we prevent the polymerization or ring formation from the aliphatic unsaturated residue and produce a mixture of an aromatic and a saturated paraffin hydrocarbon. It would, of course, be possible to use hydrogenation catalysts to produce from such a mixed aromatic hydrocarbon having a long branched chain, a naphthenic hydrocarbon and a paraffin hydrocarbon or even two paraffin hydrocarbon molecules. Industrially, however, we do not use catalysts as it is desirable to avoid this excessive saturation resulting in a knocking motor fuel.

A further reason why hydrogenation catalysts are avoided in Berginization of petroleum is the difficulty of recovering them for re-use. Catalysts are expensive, must be used in considerable quantities, and moreover, as yet, the catalysts we know of are readily poisoned by sulphur, carbon, and other materials present or produced in the cracking mixture.

The conditions mentioned above apply particularly to petroleum oils. In the case of coal or coal tar we have an initial material containing oxygen compounds such as phenols and these need hydrogenation catalysts for the purpose of eliminating the hydroxyl group. Other catalysts can be used to remove sulphur and still others to hydrogenate aromatic hydrocarbons. These many possibilities require different catalysts and sometimes different conditions. Many patents have been taken out for elements, compounds and mixtures said to be suitable for these different purposes.

The I. G. Farbenindustrie has been particularly active in patenting catalysts of these types. However, we wish to emphasize the fact that for Berginization of petroleum no catalysts have to be used and, in general, catalysts are not desirable.

In the present paper we will refer to some of the fundamental work on the Berginization of petroleum oils. The references are only to publications in scientific periodicals. We have refrained from the use of the patent literature on account of the difficulty of understanding the particularly complex publications in this field.

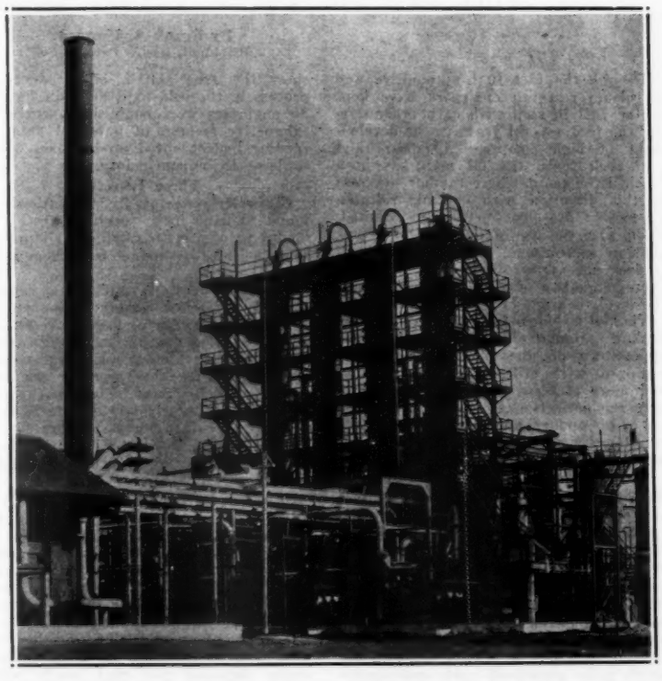
Berginization Without Catalysts

The following petroleum products have been subjected to Berginization without

(Continued on Page 212)

TABLE 1

Temperature of reaction:	Cracking without hydrogen	Cracking with hydrogen — Low temperature	Cracking with hydrogen — High temperature
Average	460° C.	440° C.	480° C.
Maximum	460° C.	440° C.	500° C.
Time of reaction in minutes	160	180	180
Gas oil used	840 g.	498 g.	500 g.
Hydrogen used	...	242 l.	217 l.
Pressure in atmos.:			
Initial	...	100	90
Maximum	70	220	245
After cooling	19	96	60
Total liquid obtained in pct. by weight	98.3	97.8	89.0
Color	black	green-brown	yellow
Gasoline to 225°:			
Pct. by weight	27.3	3 4	46.0
Sp. gr. 15° C.	0.7535	0.7915	0.7466
Kerosene fraction 225-300°:			
Pct. by weight	32.5	43 2	20.5
Sp. gr. 15° C.	0.857	0.844	0 898
Residue over 300°:			
Pct. by weight	36.7	51.7	14
Sp. gr. 15° C.	0 941	0.880	1.012
In gasoline, pct.:			
Unsaturates	4 5	4	4
Aromatics	16 5	16	14 5
Paraffins and naphthenes	79	80	81.5
Aniline point after removal of unsaturates and aromatics	63.8°	67 2°	61 0°
Gas and losses, pct. by weight:			
By cracking	1.7	2.2	11.0
By distillation	1 6	...	8.5



Debutanization plant at the Bayway, N. J., refinery of the Standard Oil Co. of New Jersey.

*The authors are with the Department of Chemical Engineering, Columbia University. Paper published by permission of the Journal of Petroleum Technologists.

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Gasoline From Signal Hill Crudes

Presence of Sulphur Has Marked Catalytic Action on the Production of Color. Operation of Plant Described

By O. C. Smith
Superintendent, Western Oil & Refining Co.

The treatment of gasoline obtained from Signal Hill crude oil is not essentially different from the treatment of gasoline obtained from any other sulphur crude, but there may be some points that will be interesting to the reader.

Signal Hill crude is about 28° to 30° A.P.I. gravity, contains approximately 1¼ per cent sulphur, and yields 28 to 32 per cent motor gasoline. About 50 per cent of the gasoline can be removed with a good color, negative copper strip test, and fair stability. The remainder, however, is quite unstable. This instability is probably due to the presence of hydrogen sulphide and free sulphur. I believe it has been quite conclusively shown that the presence of sulphur has a marked catalytic action on the production of color in gasoline.

In the operation at this plant, Nos. 1, 2 and 3 stills run in parallel, and No. 4 in series with the other three. The crude is charged through heat exchangers, and enters the evaporator tower at 360° F. where it is flashed and approximately 50 per cent of the gasoline content is removed. The bottom from this tower is pumped into the three gasoline stills, where the remainder of the gasoline is taken off. The bottoms of these stills pass into No. 4 still, where the kerosene comes off as an overhead product and the gas oil is taken from the bottom of the tower. The fuel oil then passes through the heat exchangers to storage. The combined gasoline stream passes through a caustic soda scrubber to the rundown tank.

Table No. 1 shows the stability of the gasoline in streams taken directly from the crude unit.

TABLE NO. 1

Streams	Color	Dr.	Corros.	Color in sunlight (3 hrs.)
Evaporator	30+	sr.	neg.	21
No. 1	21+	sr.	pos.	—1 (dk. pink)
No. 2	29+	sr.	pos.	—2 (dk. pink)
No. 3	27+	sr.	pos.	—2 (dk. pink)

It will be noticed that the evaporator stream has a good color and a negative copper strip test, and that, after three hours in the sunlight, it dropped to 21 color. This, as I have said before, constitutes approximately 50 per cent of the gasoline. The remainder, which is taken from the stills, comes off having a positive copper strip test and a good color, but this drops rapidly. In fact, it is difficult to take a sample from the look-box and get it into the laboratory without having a decided change in color.

Table No. 2 shows the properties of these combined streams, which all run into one tank.

TABLE NO. 2—GASOLINE DISTILLATE—BLEND OF ALL STREAMS

Color	27
Doctor	Sr.
Strip	Pos.
3 hours in dark	23 (pink)
3 hours in sun	15 (pink)

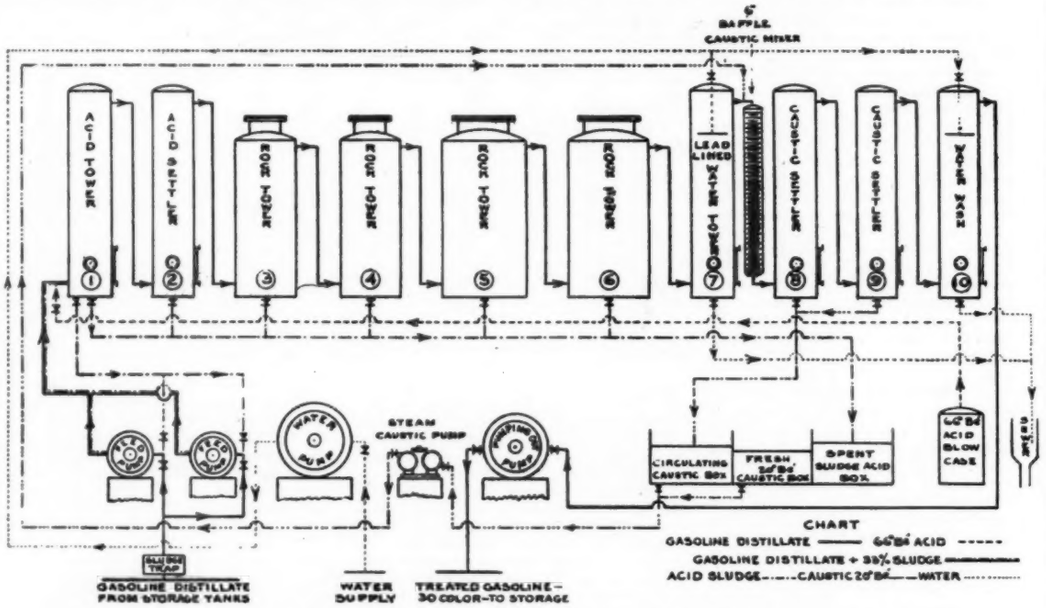
The unscrubbed gasoline has a good color when it gets to the tank, but this tends to drop rapidly, and, although the table shows that a drop to only 22 in the dark in three hours, there are times when the raw naphtha, pumped to the agitator from the rundown tanks, is brown. Treating this product means, of course, that a large quantity of acid is necessary. If the crude naphtha is given an alkaline wash on its way from the look-box to the storage tank, it has been found that the color stability is increased, and the acid required to obtain a stable colored gasoline is decreased.

Treating Unwashed Product

In treating the unwashed product, 3 to 4 pounds of acid per barrel are required. In treating the caustic washed product, only one-fourth pound is required. Some experimental treats along this line are listed below.

One of the difficulties experienced in the treatment of the crude naphtha without a precaustic wash is to obtain a product which will show a good copper strip test. This, I believe, is due in a large measure to the fact that there is no direct reaction between sulphuric acid and free sulphur. The removal of sulphur by sulphuric acid is probably due to absorption. Hydrogen sulphide reacts with the sulphuric acid, sulphur being set free, thus, unless a precaustic wash is given

(Continued on Page 206)



Flow chart of continuous straightrun gasoline treater at Wilmington, Calif., refinery of the Western Oil & Refining Co.

Hydrogenation and The Motorist

Motor Fuels and Oils to Be Made Available to Consumers This Year for Use in Higher Compression Engines

By Frank A. Howard
President, Hydro Patents Co.

Despite the fact that automotive and petroleum research engineers have kept pretty well in step with each other during the past several years in the development of high compression motors and antiknock fuels, the oil man has been reached the point where further progress in this direction with existing refining processes appears definitely limited. Even with the use of the maximum permissible percentage of tetraethyl lead, it does not appear feasible to raise the average quality of gasoline much above the level required by existing motors.

The situation today, as described by leading automotive engineers, is that the appearance on the highways of cars equipped with still higher compression and more efficient power plants awaits only the perfection of motor fuels capable of operating under these higher compression ratios without knocking or tending to break down.

It now appears that the answer to the demand for a gasoline and oil capable of operating satisfactorily in the automobile engine of tomorrow will be furnished by hydrogenated fuels and lubricants.

Fortunately, modern science has not stopped at giving the industrial world an ever mounting succession of improved processes. It has gone further and developed innumerable testing instruments which take guesswork and enthusiastic claims out of the picture entirely, and show the true worth of product or process in the cold light of plain figures. So engineers were enabled to secure an exhaustive amount of practical data regarding hydrogenated products on which to base their conclusions.

Three Effects

Generally speaking, hydrogenation was found to have three specific effects. It tended to purify, to stabilize and to render the finished product more homogeneous.

1. All crude oil contains a certain amount of foreign substance—compounds of nitrogen, oxygen and sulphur—in addition to the mixture of hydrocarbon compounds of which it is essentially composed. The free hydrogen in the new process attacks these substances vigorously and unites with them to form various gases which can be separated off later. Any hydrogenated oil, therefore, is first of all an almost chemically pure hydrocarbon mixture.

2. From an engineer's standpoint, the stability of an oil lies in its actual resistance to chemical change while in storage or in use. Coming down to practical cases, if a highly antiknock gasoline tends to change its molecular structure while in storage or in use so that it loses its antiknock character, or develops gums, resins, acids or other objectionable compounds, its value is naturally impaired just that much. The particular value of hydrogenation in this respect is that it turns out a product not only free from foreign substance but stable.

3. The third general effect of the process is a bit more involved, but the practical connection of the essential point is immediately apparent. Crude petroleum, as well as its heavier products (including lubricating oils), when refined in the usual way, contains varying proportions of hydrocarbon compounds of a highly complex structural nature. When the hydro engineer reports that he can "homogenize" heavy oils, he means that in the resulting hydrogenated product the more complex molecules will have been broken down or reformed and the oil will then be composed entirely of more refractory, simple hydrocarbon molecules. One value of a homogeneous oil is the fact that it is more refractory than one containing complex hydrocarbon molecules. Translated into practical engine performance, this means that a homogeneous oil tends to retain its physical and chemical properties in service for longer periods and under more adverse conditions.

Hydro Lubricants

The foregoing may be called the general effects of hydrogenation. What the motorist is interested in, however, is what practical influence the process is going to have in supplying him with automotive fuels and lubricants. From a

(Continued on Page 206)

Combating Corrosion With Ammonia

Large Savings in Equipment Result When Chemical Is Properly Applied. Explain Latest Developments in Utilization

By E. R. Woodward

A survey of the oil refineries on the North American continent reveals the increasing seriousness of the corrosion problem. The ravages of corrosion affect the petroleum industry at many points, as, for example, at the well and gathering lines, in field storage tanks, in pipe line equipment, in pipe line and refinery tanks and in refinery equipment. Much of the literature on corrosion during the last two years has generalized rather broadly, and it has seemed difficult for the refiner to pick out specific information which he could at once apply in his refinery on a practical basis.

The object of the present article is to narrow down the subject of corrosion, emphasizing its effect on refinery distillation equipment and showing from practical experience gained around the refineries the means of combating it.

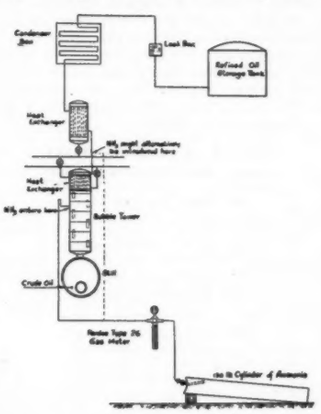


Figure 1—Flow sheet showing method of applying anhydrous ammonia for combating corrosion in distillation equipment.

Speller and Chappell estimate that the cost of corrosion in refinery equipment per barrel per day capacity is $16.70 per year. Using this factor, a simple calculation will at once show the enormous annual loss sustained by refiners who are not applying effective means to stop corrosion. Other fundamental advantages which result from reducing the corrosion bill are:

1. Fewer repairs, or less shutdown time.
2. Decreased fire hazard.
3. Increased safety of operators due to equipment being economically maintained in good working condition.

Cause of Increased Corrosion

The principal cause of more widespread interest in corrosion of refinery equipment is the refining of so-called "sour" crudes. In many refineries crude oils are being refined which a year or two ago would have been thought too corrosive to be put through the equipment. The present trend of petroleum production in the United States is toward crude of higher sulphur content, a great deal of which comes from West Texas and from California.

Two very good reasons why these sources of supply will continue to be drawn upon are:

1. The sour crudes are cheaper than the so-called "sweet" crudes.
2. They also contain a high proportion of those hydrocarbons which impart a high antiknock quality to gasoline refined from them.

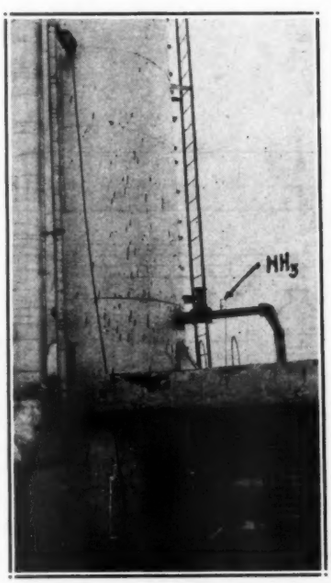
Refiners who today are operating on sweet crude and have a definitely assured source of supply are indeed fortunate so far as depreciation losses are concerned. Others, however, have to be prepared to reckon with the probable necessity of handling corrosive crude when a change is made in their source of supply. The writer came across one case where such a change-over caused a vapor line on the kerosene stream between the bubble tower and the condenser box to corrode completely through on the lower side in two months. Another extreme case was that of a wrought iron vapor line which corroded through in four days.

It is well known that corrosion of refinery equipment is caused by certain sulphur compounds, principally hydrogen sulphide, and by hydrochloric acid formed by hydrolysis of magnesium chloride in the brine associated with the crude oil. Mead has shown, however, by adding sufficient alkali to Crane-Upton crude to neutralize the hydrochloric acid developed on distillation, that hydrogen sulphide corrosion is not so serious.

Impurities found in a representative sample of Panhandle (Texas) crude were reported to be as high as 500 grams of salt (sodium chloride) per barrel, with more than traces of hydrogen sulphide, magnesium chloride, colloidal shale and iron sulphide, this latter being from the production and pipe line equipment used for transportation. In this case the crude had to be dehydrated in an evaporator before passing through the heat exchangers, otherwise the exchangers would become plugged up with salt in a few days.

Samans reports that chromium iron and chromium nickel iron alloys have proved highly resistant to sulphur corrosion, but these alloys are not highly resistant to hydrochloric acid corrosion such as exists in the cooler parts of the apparatus.

Practical studies of the two chief inorganic salts, sodium chloride and magnesium chloride, contained in the brine associated with crude oil, show that under ordinary conditions the former is noncorrosive, while by decomposition the latter becomes highly corrosive to the condensing side of refinery equipment. Dry sodium chloride at 900° F. did not dissociate nor show corrosive action on metal test strips exposed to it for 24 hours.



View showing ammonia intake to bubble tower to combat corrosion condition.

Hydrated magnesium chloride, however, reacted quite differently. The stable form which is usually present in crude oil emulsions contains 6 molecules of water, and is represented by the formula $MgCl_2 6H_2O$. On heating, its decomposition proceeds by gradual elimination of the water. On approaching the condensing stage in refinery distillation, as the dry magnesium chloride cools to 223° F. in the presence of water vapor, the simplest reaction which takes place is as follows:

$$MgCl_2 + 2H_2O = Mg(OH)_2 + 2HCl$$

The hydrochloric acid thus formed gives rise to severe corrosion which is most in evidence in vapor lines on gasoline and kerosene streams, also in partial and total condensers which carry cold crude oil or water as a cooling medium. The condensate which deposits on these cold inner surfaces accelerates hydrochloric acid corrosion.

Chemicals for Corrosion

Corrosion elimination in this case like perpetual motion seems to be just beyond our reach. Even Shakespeare draws an analogy between the two when Falstaff says: "I were better to be eaten to death with rust than to be scoured to nothing with perpetual motion."

Although we cannot as yet entirely eliminate corrosion of refinery equipment, it can be enormously reduced by a proper selection and application of chemicals. Various reagents have been tried for this purpose and it should be mentioned that the most efficient corrosion prevention involves, in certain cases, the separate treatment of the low temperature side and the high temperature side of the equipment.

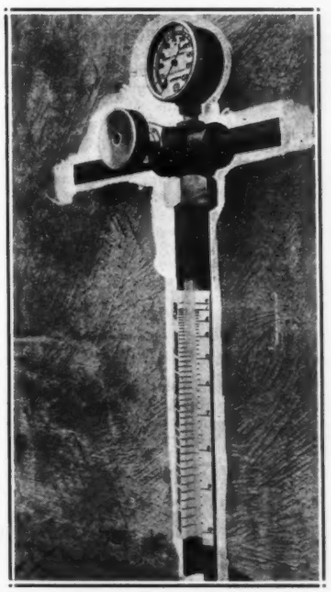
Experience has shown that anhydrous ammonia is the best and most convenient neutralizer for hydrochloric acid corrosion in the low temperature or condensing side of refinery equipment. The American Petroleum Institute report on corrosion states that installations are known where, with the use of caustic soda, it was necessary to renew the bottom collecting headers, gasoline coolers and rundown lines in three to six months. When ammonia was used in place of caustic, the life of these parts was increased to more than a year. The quantity of ammonia required varied from 3 to 25 pounds per 1,000 bbls. of crude processed.

Ammonia is not suitable for the high temperatures and pressures encountered in cracking coils. In this region sulphur corrosion has to be attacked, and as is well known the low dissociation temperatures of sulphur compounds of ammonia render it unsuitable here. For this purpose hydrated lime is the best reagent. In one case, where Winkler crude (West Texas) containing 1.62 per cent sulphur was treated with one-fourth pound of hydrated lime per barrel, the life of the tubes in the hottest part of the furnace was increased from three months to more than a year.

Thus we find that a judicious combination of ammonia and lime applied separately to their respective sides of the equipment offer the most effective chemical means of combating the corrosion problem. By introducing anhydrous ammonia into the top of the bubble tower or into the vapor line after it leaves the tower, and injecting a lime-oil slurry into the pipe still by way of the crude oil charging line, it has been found possible to reduce corrosion almost entirely in topping Winkler County (West Texas) crude. This method is equally applicable to cracking.

Application and Control

The use of lime presents little or nothing unusual, but there are points of general interest in the application of anhydrous ammonia which are worth mentioning. In arriving at decisions as to methods to be employed, selection of the best combination of materials must depend upon operating convenience, flexibility of control and other factors. Lack of time often precludes extended experimental work, so that tests cannot be run for results which must be immediately applied. On account of its simplicity and inexpensive application this is where anhydrous ammonia can be used to advantage, as illustrated in the line drawing (see Figure 1). The practical application of anhydrous ammonia for corrosion prevention is relatively simple. First of all, it is necessary to decide upon the most suitable point in the distillation equipment at which to introduce the ammonia. This will be governed by the location of the point of worst corrosion. A half inch hole tapped in the vapor line, or other part of the equipment, will take the line from the ammonia cylinders. It is well to have a



Ammonia flow meter which registers by means of direct readings on the scale, pounds of ammonia flowing per 24 hours.

trap consisting of an inverted U rising 3 or 4 feet upward from the vapor line connection. Failing this, a check valve may be used in the half inch ammonia line, the object being to prevent condensation and flow of liquid down the line into the flow meter.

Figure 1 shows a flow sheet of a conventional type shell still with bubble tower, heat exchangers, condenser, look-box, and rundown tank. A cylinder of anhydrous ammonia was set on the ground with the outlet raised slightly. The cylinder was turned around to such a position that the goose-neck pointed to the top inside the cylinder and the ammonia was thus taken off as a gas. It then passed through the flow meter which by means of an orifice and manometer registers on the scale a direct reading in pounds of ammonia flowing per 24 hours. The differential control valve may be set to give a predetermined rate of feed correct to within 2 per cent. The point of injection of the ammonia in this case was tried successively at two different points: First, about half way up the

(Continued on Page 222)

Vapor Phase Treating and Knock Rating

Gasoline From Cracking Operation Has High Octane Number. Chemical Properties of Finished Product Unusual

By D. F. Gerstenberger and R. E. Goode
American Refining Properties

INCREASING ANTIKNOCK RATING OF GASOLINE

In this article the authors discuss a vapor phase treatment under high pressures and temperatures, introducing an important departure in the production of gasoline high in antiknock value. The length of usefulness of the treating clay is a feature and the following surprising result is described: "So far, the operation of the high pressure clay tower has reversed the usual experience in low pressure operation. Instead of a gradual increase in gums and decrease in color, the color has remained consistently around 30 Saybolt, while the gum content of the gasoline continues to show a decrease."

In low pressure operations the maximum life of the clay has been from 1,000 to 2,000 bbls. of gasoline per ton of clay. In the high pressure operations, under higher temperatures, the tower is still operating with the original charge of clay after treating 5,498 bbls. of gasoline per ton. It is pointed out that the additional vapor temperature may be above the melting point of the polymers so that these are washed out of the clay as they are separated from the gasoline. About 150 gallons of gasoline per hour are washed back over the clay tower to prevent retention of these polymers.

The growing interest in antiknock gasoline produced from cracking stills has centered the petroleum refiner's attention upon its particular method of manufacture. In the cracking or conversion of residual oils into antiknock gasoline the best results are obtained in knock rating through cracking of asphaltic base fuels, and especially high benzol equivalents are the result when the refiner has facilities for retaining the relatively large percentages of olefins, as in the clay treatment of the gasoline in the vapor phase.

There is no loss appreciably of unsaturated compounds in the gasoline in the clay treating process. The recovered condensate is 30 Saybolt color and needs no acid treatment. In the Dubbs unit equipped with Gray tower holding 30 tons of earth the recovered gasoline receives no other treatment than passing the condensate through lime for the removal of hydrogen sulphide and thence sweetening with doctor by recirculation with the addition of a small amount of sulphur.

The result is a gasoline having an octane number of 76 plus; gravity, 60/62; initial, 85/95° F.; endpoint, 385/390° F. The Engler distillation, as illustrated in the accompanying graph, shows:

Per cent	Degrees F.
10 over at	130
20 over at	160
30 over at	194
36 over at	212
40 over at	224
50 over at	244
60 over at	270
70 over at	300
80 over at	330
90 over at	358
	Per cent
Recovery	96.5
Residue	1.0
Loss	2.5
Sulphur	0.086
	Mg.
Gum	11

Of interest in relation to the formation of gum resins it is noted that since the continued operation of the clay tower from the first 250 bbls. of gasoline per ton throughput up to the present of 5,498 bbls. per ton there has been a consistent reduction in gum readings. At the present time there has been processed through the clay tower a total of 164,932 bbls. of condensate.

Color Stability

The color of the gasoline recovered is still averaging 30 Saybolt and is showing no indication that the clay is deteriorating in decolorizing properties. It was noted early in the beginning of the use of the clay tower that color stability in the gasoline was in a large measure dependent upon the amount of free sulphur used in sweetening. It was also found that excessive use of sulphur in the doctor was responsible for the tendency of the finished gasoline to cloud. By proper sulphur control the gasoline is stable in the sunlight to a drop of 3 points in three hours and is water white after eight hours.

In checking the cloud formed in the gasoline, it was found that by filtering through ordinary filter paper the cloud could be removed and a better Saybolt color reading obtained. It was assumed that in the use of the large amount of free sulphur the equilibrium of the oxidized sulphur molecules is disturbed so that partial reaction takes place in the sunlight resulting in the formation of acid esters. However, this theory is somewhat shaken by the fact the tendency to cloud was much more noticeable early in the new clay or up to the first 1,000 bbls. per ton. By the addition of a very small amount of a solution of ammonia to the gasoline during this time the cloud was retarded. Experimental work with aniline as an inhibitor and the inhibitor known as Du Pont No. 2, indicated that the cloud when present could be eliminated. An objection to use of ammonia solutions was that the odor of free ammonia was always apparent.

Gum Content

The interesting observations in regard to gum were made at intervals of 1,000 bbls. of gasoline per ton of clay up to the 5,000 bbls. per ton as shown by tests with both the copper and glass dishes on the steam bath. Higher gum readings with the copper dish over that of the glass dish were hard to determine. In checking for the difference in results an empty copper dish and an empty glass dish were placed upon the bath for four hours and then checked for a gain in weight. The polished copper dish had gained a plus 1 milligram with no gain in weight of the glass dish. No precautions were taken against the fairly strong circulation of air passing over the cups. The copper dish being somewhat discolored, it was assumed that some oxidation of the copper had taken place with a resultant gain in weight.

GUM IN CLAYED GASOLINE

Doctor Test Sweet and Sour	
"SOUR"	"SWEET"
250 Bbls. per Ton Clay	
Glass dish... 20 mg.	Glass dish... 25 mg.
Copper dish. 25 mg.	Copper dish. 30 mg.
1,000 Bbls. per Ton Clay	
Glass dish... 20 mg.	Glass dish... 20 mg.
Copper dish. 25 mg.	Copper dish. 25 mg.
2,000 Bbls. per Ton Clay	
Glass dish... 15 mg.	Glass dish... 20 mg.
Copper dish. 25 mg.	Copper dish. 25 mg.
4,000 Bbls. per Ton Clay	
Glass dish... 11 mg.	Glass dish... 20 mg.
Copper dish. 20 mg.	Copper dish. 25 mg.
5,000 Bbls. per Ton Clay	
Glass dish... 9 mg.	Glass dish... 11 mg.
Copper dish. 16 mg.	Copper dish. 17 mg.

From the above results it was determined that on sweetening and storing the gasoline, some increase in the amount of gum was the result. The gum formed, however, is not of a resinous, sticky type, but is very hard. When used in an overhead valve motor for a long period of

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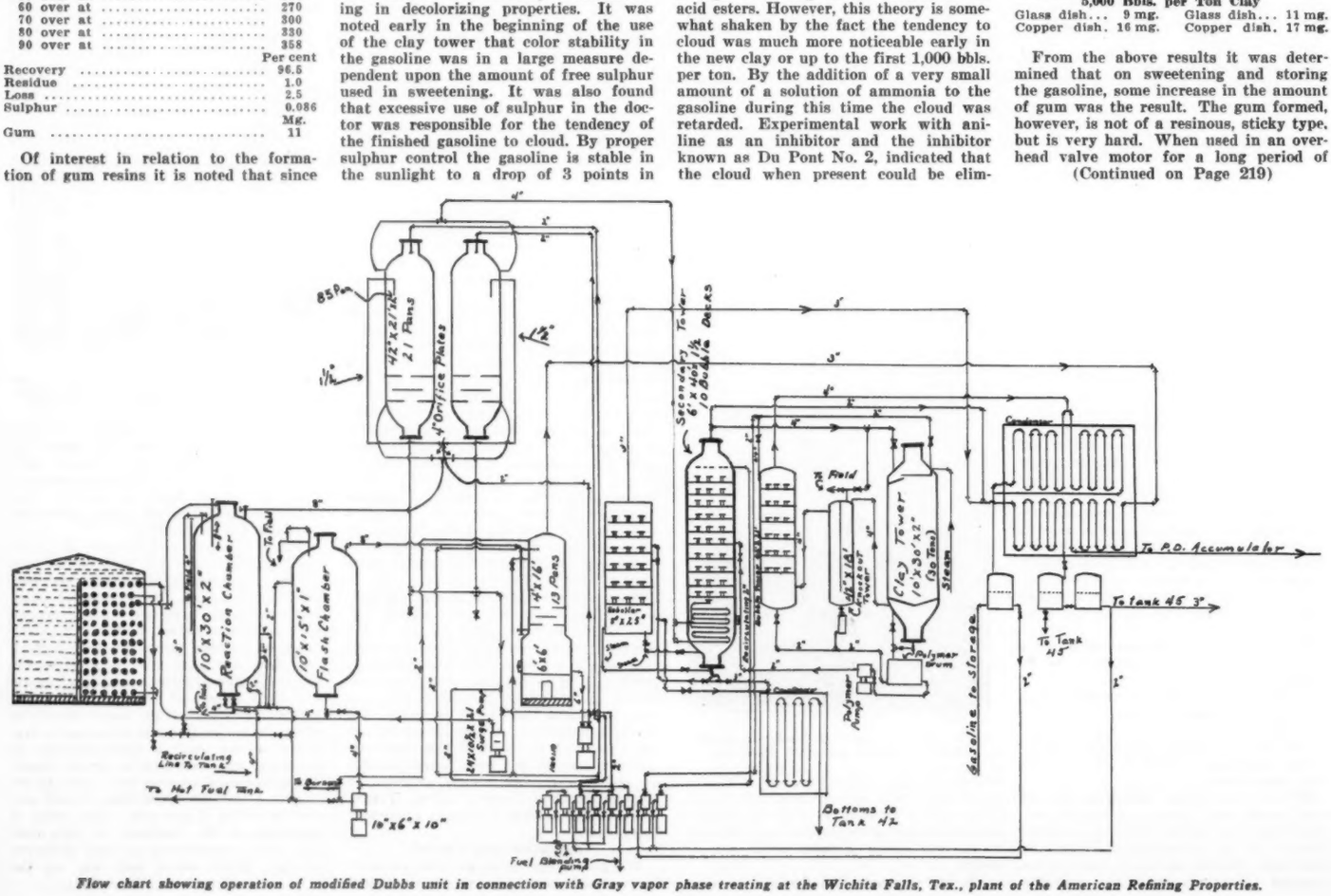


Flow chart showing operation of modified Dubbs unit in connection with Gray vapor phase treating at the Wichita Falls, Tex., plant of the American Refining Properties.

Purification of Pressure Distillates

Quantity and Strength of Sulphuric Acid Used Directly Related to Losses and Characteristics of Finished Gasoline

By E. H. Potthoff
White Star Refining Co.

The great increase in volume of cracked gasoline produced during the past year has made the problem of the losses produced by refining with sulphuric acid of ever-increasing importance. The following study was made in an attempt to evaluate as nearly quantitatively as possible the relative magnitude of the volumetric losses, due to sludging and polymerization, and the resulting loss in antiknock value.

A sample of untreated cracked gasoline was prepared from Dubbs pressure distillate. This 405° endpoint distillate was treated with varying amounts of sulphuric acid of both 60°Be. and 66°Be. The sludge loss was assumed to be the volumetric loss of the distillate corrected for evaporation occurring during the treatment. All treats were carried out at 60-70°F. The clear oil containing a small amount of acid was neutralized with 10 per cent of 10°Be. causic soda solution and redistilled. The neutralization losses were very erratic, due to the occasional formation of a persistent emulsion, and have therefore not been included in the tabulation of treating losses. The magnitude of the neutralization loss is apparently dependent to a considerable degree upon the effectiveness of the separation of the sludge from the oil layer, which separation we were apparently not able to control satisfactorily.

The neutralization loss will exist in all commercial installations and may readily attain a considerable magnitude. For this reason the losses tabulated are somewhat lower than the actual plant losses for the same quantity of acid. The neutralized oil was redistilled over caustic soda in order to avoid the use of steam, which would render duplication of fractionating conditions difficult. In this way the evolution of SO_2 was eliminated and the possible effect upon the color and antiknock avoided. The volume of the residuum remaining in the flask, less the residuum from the blank, when no acid was used, gave us the quantity of heavier hydrocarbons formed in the treatment. The heavier hydrocarbons remaining in the flask were designated as polymers although this classification is not strictly correct, for some of the polymers were undoubtedly dissolved by the sludge and some higher boiling sulphuric acid combination products were soluble in the oil. The voluminous evolution of SO_2 from the heavier acid treats, which were rerun without attempting to prevent decomposition, indicates that the distillation residuum may in all probability consist, to a considerable extent, of high boiling sulphuric acid combination products.

SULPHURIC ACID AS TREATING AGENT

In the accompanying article, the author gives the results of a study of the sludge and polymerization losses produced when refining an endpoint Dubbs cracked distillate with both 60° and 66° sulphuric acid.

The report covers the effect of this treatment on the antiknock and boiling range of the treated gasoline. This includes the effect of time of contact between the cracked distillate and the treating reagents. Detailed data are given and results enumerated.

Increased Use of Acid

The effect of increasing the amount of acid upon the sludge and polymerization losses is shown in Table 1. The A.S.T.M. distillation, color and knock rating of the treated gasoline are also shown. The knock ratings were made on a Series 30 Ethyl engine to determine the number of cubic centimeters of tetraethyl lead required to bring the sample up to the knock rating of Ethyl Standard Gasoline No. 22.

The benzol equivalents were selected from a curve compiled in this laboratory. This conversion curve was prepared by determining the amount of tetraethyl lead required to equal the antiknock value of Ethyl Gasoline Corp. Standard No. 22. This amount of lead was compared with the quantity of chemically pure benzol required to be added to the straightrun Pennsylvania gasoline to produce a fuel of the same knocking characteristics. This method of reporting antiknock values has been satisfactory within our own organization; however, it is almost valueless when used as a basis of comparison between different laboratories, for it assumes straightrun Pennsylvania gasoline to have a constant antiknock value, which has not proven to be the case. We have found straightrun Pennsylvania gasolines to vary as much as 18 per cent on our scale.

The octane numbers were determined by comparing the amount of tetraethyl lead required to bring the unknown fuel up to the knock ratings of two secondary standard fuels supplied by the Standard Oil Development Co. These two fuels have certified octane numbers. The Ethyl Gasoline Corp. supplied us with curves showing the relationship between the octane number and the number of cubic centimeters of tetraethyl lead to be added to equal the antiknock performance of the two secondary standard fuels. These fuels together with the curves from the Ethyl Gasoline Corp. enable us to determine with considerable accuracy the octane number of any fuel between the limits of 50 and 84. This method also allows us to eliminate the use of the rather costly primary standard reference fuels, iso-octane and normal heptane.

An inspection of these data indicates that the sludge loss reaches a considerable magnitude as the amount of acid exceeds 5 pounds per barrel. The ratio between the sludge loss and the so-called polymerization loss decreases, as the amount of acid increases. However, the variation is slight and the ratio could be assumed as constant without appreciable error. Fortunately the loss of antiknock is not excessive until more than 10 pounds of acid is used. At 10 pounds per barrel the direct loss in product value due to the loss in antiknock may be assumed to be the cost of the tetraethyl lead required to raise the antiknock back to the original value. At 0.35 cent per cubic centimeter this amount would be: $(0.5 - 0.1) \times 0.35 \times 42 = 5.88$ cents per barrel.

The effect of the acid in raising the boiling range of the treated gasoline is apparent from the distillation data. Obviously the action of the acid is concentrated to a greater extent on the lower boiling hydrocarbons than on those of higher boiling point. If the action were uniform the boiling range of the product would be unaffected by the amount of acid used. The gum content was determined by means of the copper dish and has little if any value, other than to indicate that an increase in the amount of acid results in more extensive removal of

(Continued on Page 230)

TABLE 1—USING 66°BE. SULPHURIC ACID—AGITATED FOR 5 MINUTES

Pounds Acid per Bbl.	Sludge Loss Pct.	Polymer Loss Pct.	Total Loss Pct.	C.C. Tetraethyl Lead per gal.	Benzol Equivalent	Octane Number
0	0	0	0	0.1	47	73
2	1.0	0.6	1.6	0.2	46	72
5	1.8	1.0	2.8	0.4	45	70
10	3.5	1.8	5.3	0.5	44	69
20	8.0	3.3	11.3	1.3	33	64
50	15.3	6.3	21.6	2.5	27	51

A.S.T.M. DISTILLATION

	Pounds Acid Used						
	0	2	5	10	20	50	Residuum
Gravity	57.2	57.3	57.3	57.0	56.6	56.1	24.0
I.B.P.	98	100	101	106	105	104	412
10	148	148	152	158	163	166	437
20	180	182	186	187	195	198	450
30	209	210	212	214	223	230	464
40	235	236	239	239	250	256	480
50	259	260	262	264	273	281	498
60	282	284	286	284	294	301	523
70	300	306	309	307	312	327	553
80	334	336	335	338	340	346	568
90	262	363	361	361	368	372	Coke
E.P.	399	397	405	410	405	404	
Rec.	98.5	98.5	98.5	99.0	99.0	98.5	88.0
Color	16	20	25	25+	25	24	
Cu. Dish Gum Mg	370	219	140	24	63	59	
Gravity residuum	28.4	28.2	27.9	27.4	25.0	24.0	

TABLE 2—TREATING CONDITIONS
Using 60° Be. Sulphuric Acid—Agitated for Five Minutes

Pounds acid per bbl.	Sludge loss pct.	Polymer loss pct.	Total loss pct.	C.C. tetraethyl lead per gal.	Benzol equivalent	Octane No.
5	1.6	0.6	2.2	0.3	46	71
10	3.7	1.2	3.9	0.4	45	70
20	4.7	1.6	6.3	0.4	45	70

FINISHED GASOLINE—A.S.T.M. DISTILLATION

Acid used—pounds	0	5	10	20
Gravity	57.3	57.3	57.1	57.0
I.B.P.	98	105	104	106
10	148	152	158	160
20	180	183	186	190
30	209	210	212	217
40	235	235	237	242
50	259	260	261	266
60	282	284	284	290
70	300	306	307	315
80	334	336	334	338
90	362	362	362	363
E.P.	399	399	404	397
Rec.	98.5	99.0	99.0	98.5
Color	16	25+	25	25
Cubic dish gum mg	370	137	80	29
Gravity residuum	28.4	29.1	27.9	30.3

TABLE 3—TREATING CONDITIONS
Using 5 Pounds—66° Acid With Varying Contact Time

Time minutes	Sludge loss pct.	Polymer loss pct.	Total loss pct.	C.C. tetraethyl lead	Benzol equivalent	Octane No.
2	1.0	0.7	1.7	0.4	45	70
5	1.8	1.0	2.8	0.4	45	70
10	2.5	1.2	3.7	0.4	45	70
30	3.3	2.0	5.3	..	..	..

FINISHED GASOLINE—A.S.T.M. DISTILLATION
Contact Time—Minutes

Time	2	5	10	30
Gravity	57.2	57.3	57.2	57.3
I.B.P.	100	101	99	100
10	150	152	152	157
20	184	185	183	188
30	212	212	210	215
40	237	239	237	240
50	261	263	262	263
60	285	286	283	287
70	307	309	307	308
80	330	335	333	335
90	360	361	362	362
E.P.	460	405	407	398
Rec.	99.0	98.5	99.0	98.5
Color	25	25	25	23
Cubic dish gum	56	140	186	69
Gravity residuum	28.5	27.9	27.9	27.1

TREATING CONDITIONS
Using 5 Pounds—60° Acid With Varying Contact Time

Time minutes	Sludge loss pct.	Polymer loss pct.	Total loss pct.	C.C. tetraethyl lead	Benzol equivalent	Octane No.
2	1.2	0.5	1.7	0.2	46	72
5	1.6	0.6	2.2	0.4	45	70
10	1.8	0.7	2.5	0.4	45	70
30	2.5	0.8	3.3	0.4	45	70

FINISHED GASOLINE—A.S.T.M. DISTILLATION
Contact Time—Minutes

Time	2	5	10	30
Gravity	57.3	57.2	57.3	57.4
I.B.P.	104	105	107	102
10	149	152	155	156
20	182	183	184	184
30	210	210	210	213
40	236	235	233	238
50	259	260	258	262
60	283	284	281	284
70	309	306	306	308
80	330	336	332	332
90	358	362	358	360
E.P.	402	399	405	406
Rec.	99.0	99.0	99.0	99.0
Color	25	25	25	24
Cubic dish gum	188	137	149	53
Gravity residuum	31.0	29.1	29.8	28.8

NATURAL GASOLINE

THE ECONOMICAL WAY TO "REFINE" BETTER GRADES OF MOTOR FUELS

JUST NATURAL GASOLINE

WARREN Petroleum Company

EXCHANGE BANK BLDG. TULSA, OKLAHOMA

A STABILIZING FACTOR IN THE NATURAL GASOLINE INDUSTRY

Fuel Research at Bureau of Standards

Considerable Fundamental Data of Direct Concern to Refiners Already Made Available. Investigations to Continue

By Oscar C. Bridgeman
Research Associate, Bureau of Standards*

The advent of the automobile and the phenomenal growth of the automotive industry changed the status of gasoline from a by-product of little commercial value to the major product of the petroleum industry. The new market for gasoline, thus created, stimulated the rapid expansion of the petroleum industry, resulting in extensive development of the national oil resources and improvements in refinery technique. Thus the last two decades have seen the rise concurrently of two of the major industries of the country, each dependent upon the other, but until very recently neither industry has been in possession of requisite information for satisfying, even partially, the requirements of the other. An ideal solution of the problem necessitates the acquisition of sufficient information to permit that mutual adaptation of engine design and fuel which would result in maximum economies for both industries.

The petroleum technologist should know how the fuel behaves in the engine in order that he may intelligently produce the most satisfactory fuel for use in engines of current design. He should know, still further, the characteristics of fuels which determine their performance in the engine and he should have adequate tests for the evaluation of these characteristics. Then with knowledge of what gasoline ought to be and with sufficient information to enable him to determine when he has such a fuel, the oil refiner is in a position to develop his refinery technique to the point where he can produce a consistently satisfactory fuel from the minimum amount of crude oil.

Scope of Investigations

For a considerable number of years, the Bureau of Standards has been working in close co-operation with the two industries on the general problem of the relation between fuel characteristics and engine performance. Much information of value has resulted from this study but much work still remains to be done in order to attain to the ideal solution outlined above. In the conduct of these investigations, a general method of procedure was followed in most cases, which can be divided into five stages:

(a) Accumulation of sufficient preliminary information to ascertain the fundamental variables involved.

(b) Investigation of the effect independently of each of these fundamental variables in a laboratory apparatus permitting precise control of the variables.

(c) Development of practical tests for the particular fuel property under consideration.

(d) Establishment of the significance of these practical tests by engine work.

(e) Study of the effect of engine design on the permissible values of the fuel property being investigated.

This type of research is intermediate between the usual industrial type and the more purely scientific type. It involves the minimum expenditure of time required to give a sufficiently general and fundamental solution to be applicable to a wide variation in fuels and automotive equipment. The different properties of fuels discussed in the following sections will be considered from the standpoint of this general procedure.

The more significant properties of a fuel for use in automotive equipment, as evidenced by the work to date, are: (1) Volatility in respect to engine starting, acceleration, distribution and crankcase dilution; (2) vapor pressure in respect to vapor lock; (3) gum content in respect to gum deposition in the manifold and on the intake valves; (4) sulphur content in respect to corrosion of the fuel feed system and in the crankcase, and (5) antiknock value.

Volatility

Preliminary information on the use of fuels in automotive equipment indicated that the ratio of air to fuel in the mixture burned in the cylinders was the most important variable in connection with volatility. Necessarily the mixture ratio burned must be between 4 to 1 and 20 to 1 since these ratios represent the limits of explosive mixtures. However, variation in the mixture burned within these limits exerts a marked effect on the engine performance. Thus the mixture ratio for maximum power is about 12.5 to 1; for maximum economy is about 15 to 1, and for maximum ease of acceleration is about 12 to 1. If a series of fuels are used in the same engine under similar operating conditions, the same performance will be obtained with all of these fuels if the ratio of air to fuel burned in the cylinders is identical in all cases. In order to obtain this same effective mixture, it is usually necessary to supply different mixtures by the carburetor in the case of the various fuels, which means that different percentages evaporate in the manifold. Therefore the supplied mixture and the percentage evaporated are also important variables. The fourth variable is the temperature, since this affects the percentage of the fuel which evaporates, and hence the resultant mixture of air and fuel vapor. The four fundamental variables in connection with volatility are, accordingly, the resultant mixture of air and fuel vapor, the supplied mixture of air and liquid fuel, the percentage evaporated and the temperature.

In order to investigate these fundamental variables, an apparatus[1] was constructed which simulated manifold conditions and data were obtained on 38 diverse fuels covering the effects of each of the four variables over wide ranges of values. This apparatus gave equilibrium volatility curves for each fuel. On analysis, it was discovered that the equilibrium volatility curves were related to the A.S.T.M. distillation curves[2] such that if the temperature and slope were known at various percentages evaporated on the A.S.T.M. curve, the equilibrium volatility values could be computed with considerable accuracy. Accordingly, the A.S.T.M. distillation test constituted a practical measure of the volatility of a fuel. Incidentally, it was found that specific gravity, initial boiling point and endpoint have no general significance as regards volatility. For comparability between different fuels, the distillation data should be plotted on a percentage evaporated basis rather than as percentages distilled according to the usual method. The percentage evaporated at any temperature is merely the percentage distilled at that temperature plus the distillation loss.

The significance of the A.S.T.M. distillation test as a practical measure of volatility from the engine standpoint was verified by engine tests. Four points in connection with engine performance are of interest, namely: Starting, acceleration, distribution and crankcase dilution. Starting tests[3] under a variety of conditions were made on gasolines of measured volatility and it was found that a definite relationship[4] existed between starting temperature, supplied mixture ratio, ease of starting and the A.S.T.M. distillation data. Assuming an engine in good mechanical condition containing oil of proper viscosity, and assuming that the carburetor supplies a 1-to-1 mixture which is representative of the average car on the road, then starting should not be difficult until the temperature drops to a value lower than approximately 140° F. below the A.S.T.M. temperature at 10 per cent evaporated. More precise relations are available taking into consideration other supplied mixtures and the effect of slope of the A.S.T.M. distillation curve. A gasoline having a flat distillation curve will permit the same ease of starting at lower temperatures as one having a steep curve and the same 10 per cent point.

For the same supplied mixture and atmospheric temperature, the fuel with the lowest 10 per cent point will give the easiest starting. Thus a fuel with a 10 per cent point of 136° F. will permit starting with half the number of crankshaft revolutions required for a fuel with a 10 per cent point of 176° F., and in 100 starts in an engine of average size 1 gallon of fuel would be saved in the case of the more volatile gasoline. Carburetor design has some effect on starting, for if a mixture of 0.5 to 1 can be supplied, the same ease of starting is obtained at about 10° F. lower temperature as with a 1-to-1 mixture. The minimum cranking speed also varies somewhat with different engines, 40 to 50 r.p.m. being sufficient in most cases.

Engine acceleration tests[5] indicated that the ease of acceleration was dependent upon the richness of the mixture supplied to the cylinders during the accelerating period, and hence was related to the A.S.T.M. distillation curve. Thus the fuel having the lowest A.S.T.M. temperature at the percentage evaporated under consideration would normally give the best acceleration. Since the engine may be called upon to accelerate during the warming-up period or after it has been run for some time, the percentage evaporated to be considered varies from about 30 to 70 per cent, depending upon the conditions. Manifold design was found to have considerable effect on absolute acceleration with a given fuel but only a minor effect on the relative ease of acceleration with a series of fuels.

Distribution in the engine is related to the percentage of fuel which is evaporated in the manifold and hence is related to the A.S.T.M. distillation curve. Up to a certain point, distribution in a multicylinder engine improves with increase in the percentage evaporated. Since the temperature of the mixture varies considerably from the time of starting until the engine is warmed up, the part of the distillation curve of significance varies from 10 to 90 per cent evaporated. Manifold design has a marked effect on the distribution but in general the relative degree of distribution with different fuels appears to be almost independent of manifold design.

Numerous engine tests on the dilution of the crankcase oil[6] showed that the extent of dilution under a given set of conditions is determined by the 90 per cent temperature on the A.S.T.M. distillation curve. The higher the 90 per cent point, the more dilution may be expected. While crankcase breathers markedly affect the amount of dilution, the relative tendency to cause dilution in the case of a series of fuels is in the order of their increasing 90 per cent temperatures.

Since the A.S.T.M. 90 per cent point is a criterion of the dewpoint[7] of the air-gasoline mixture, it is also a measure of the maximum temperature to which the mixture should advantageously be heated in the manifold. If the air is heated to too high a temperature, the volumetric efficiency may be considerably reduced with consequent loss in power. While mileage and power differ hardly at all in the case of different gasolines in the absence of severe detonation if the same mixture ratio is used, this adjustment of mixture is not normally made and a fixed carburetor setting is employed. Under these conditions, mileage and power will vary somewhat dependent upon the A.S.T.M. distillation curve, for as mentioned previously the mixture ratios for maximum power and maximum economy are 12.5 to 1 and 15 to 1, respectively.

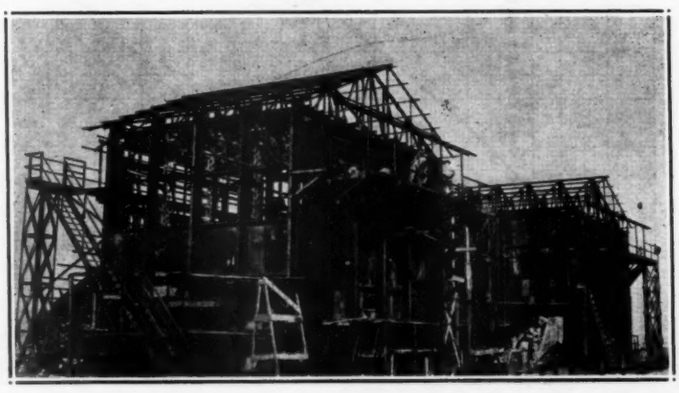
Vapor Pressure

In the discussion on fuel volatility, it was pointed out that the A.S.T.M. distillation curve is a measure of the performance characteristics of a series of fuels in the engine. This implies that no difficulty is encountered in getting the fuel into the induction system, which is not always the case, for gasolines may boil in the feed system with resultant interruption of flow. The fundamental property of a fuel which determines its tendency to boil, or to cause trouble

(Continued on Page 226)

*Publication approved by the director of the Bureau of Standards of the Department of Commerce.

[1] S.A.E. Journal, April, 1926, Page 393; April, 1928, Page 437; A.P.I. bulletin, January 31, 1928, Page 54.
[2] S.A.E. Journal, October, 1929, Page 345.
[3] S.A.E. Journal, July, 1925, Page 52; February, 1926, Page 147; July, 1926, Page 3; A.P.I. bulletin, January 31, 1927, Page 143.
[4] S.A.E. Journal, March, 1927, Page 353; October, 1929, Page 345.
[5] S.A.E. Journal, September, 1928, Page 235; July, 1929, Page 669; April, 1930, Page 471; September, 1930, Page 275.
[6] S.A.E. Journal, July, 1924, Page 69.
[7] S.A.E. Journal, November, 1928, Page 478.



Furnaces for 10,000-bbl. cracking unit under construction at Avon, Calif., refinery of the Associated Oil Co.

Seasonal Gasoline Changes Practical

Phillips Company Varies Motor Fuel Specifications in Line With Climatic Conditions. Based on Four Operating Features

By R. C. Alden
Research Department, Phillips Petroleum Co.

As long ago as 1923 the United States Bureau of Mines[1] demonstrated the comparatively slight differences in volatility between the summer and winter gasolines generally marketed. It would appear reasonable to expect better performance with gasolines of more pronounced seasonal characteristics. For several years precise research work has been studying this problem with the result that it is now possible to definitely evaluate the operating characteristics of a given motor fuel. It is the purpose of this paper to present in practical form the more important conclusions in regard to the effect of volatility on the four items of motor fuel performance which are influenced by variations in motor fuel volatility. The four features are: (1) Vapor locking tendencies, (2) ease of starting, (3) warming-up characteristics, (4) vaporization under steady driving conditions.

At the outset it would appear desirable to state that volatility of motor fuels can best be defined in general terms as the ability of the gasoline to vaporize under the equilibrium conditions existing in the intake system of the engine.[2] With this definition in mind it is obvious that the vapor pressure of a motor fuel is a very limited measure of its volatility, because the equilibrium conditions existing during a vapor pressure determination do not exist in the intake systems of engines beyond the carburetor needle. For this reason, volatility characteristics other than vapor pressure are far more important in determining desirable features of motor fuel performance. As a matter of fact, the conclusion has been reached that the only useful function performed by a vapor pressure specification is to safeguard against the undesirable feature of vapor locking tendencies.

Vapor Locking Tendencies

Much work has been done in this connection. Perhaps the most useful generalization so far made is Brown's[2], in which he states that to avoid vapor locking tendencies, the A.S.T.M. 10 per cent evaporated temperature must exceed 100 plus one-half the atmospheric temperature. The constant 100 is dependent on the maximum temperature attained in the fuel systems and provides for all automotive fuel systems, even the most poorly designed. With reasonable attention to fuel system design the constant can be reduced from 100 to 80.[3]

The relationship above described does an injustice to those motor fuels which have low 10 per cent temperatures and comparatively low vapor pressures. Furthermore, it makes motor fuels with high 10 per cent temperatures and comparatively high vapor pressures seem better than they actually are. Vapor locking tendencies are primarily dependent on the vapor pressure of the gasoline in the fuel system[3,4] at the temperature prevailing therein. It has been shown[3] that motor fuels having the same vapor pressure can have 10 per cent evaporated temperatures varying as much as 25° F. Consequently it seems desirable to use maximum vapor pressure as a safeguard against vapor lock, rather than a minimum 10 per cent evaporated temperature. For this purpose, an average relationship between Reid vapor pressure and vapor locking tendencies is shown in Figure 1 (See Figure 5). This is based on Brown's formula and an average relationship[5] between the Reid vapor pressure and the 10 per cent evaporated temperature.

The considerable influence of fuel system design on vapor locking tendencies is clearly demonstrated in the chart. It is believed that sufficient progress has been made in the design of fuel systems to permit use of the zone between the curves for 90 and 100 in Figure 1 (See Figure 5).

Bridgeman and Cragoe[6] developed formulae and graphs relating ease of starting to the A.S.T.M. distillation curve. This relationship has been verified by Brown.[3] The formula expressing this relationship is as follows:

$$\frac{Td}{Te} = 1.372 + 0.005\ (Rv - 16) \pm 0.000045\ (P - 50)^2, \text{ where}$$

Td = A.S.T.M. distillation temperature at P per cent evaporated in degrees Fahrenheit plus 460.

Te = Engine, or atmospheric, temperature in degrees Fahrenheit plus 460.

Rv = Resultant air-vapor ratio.

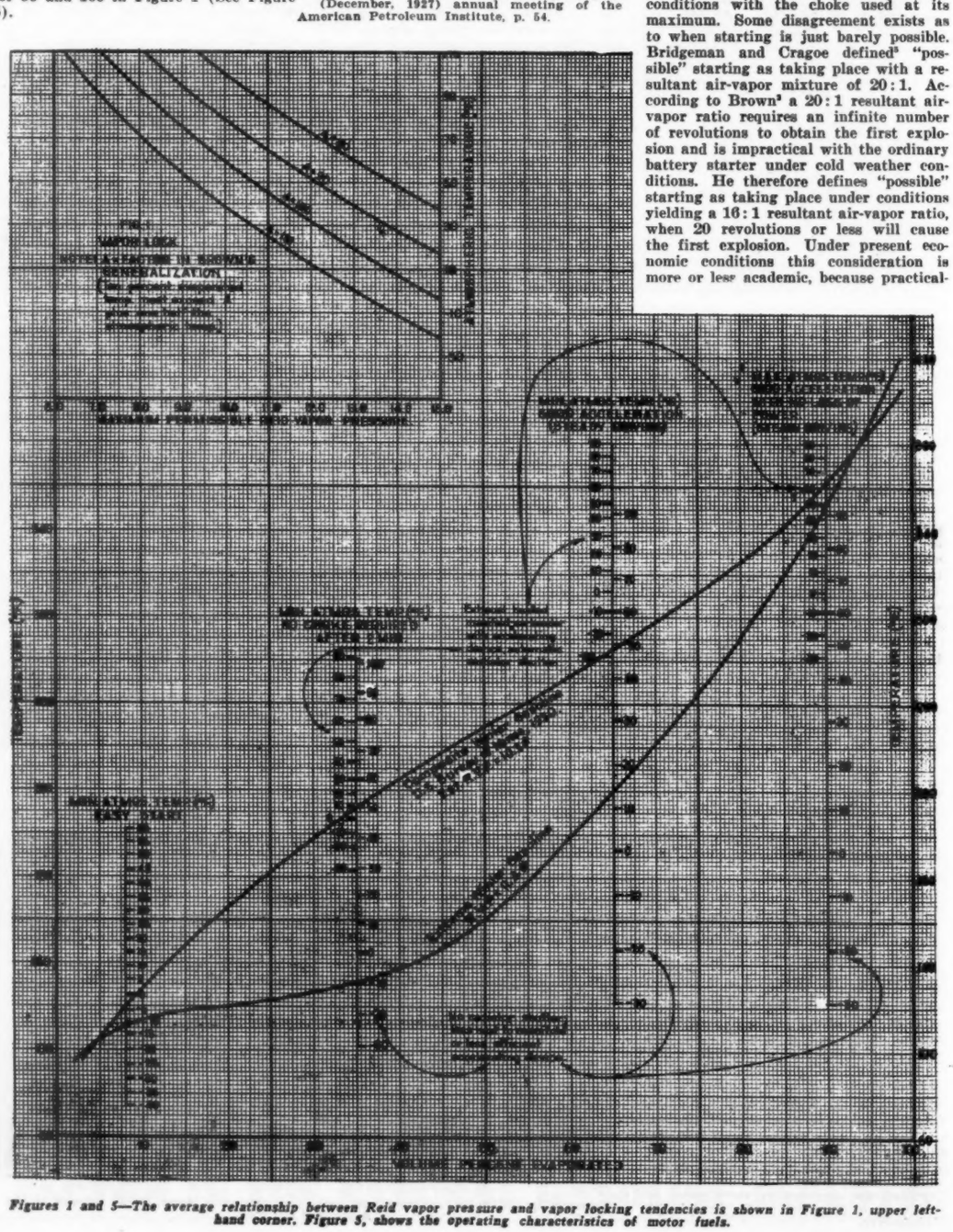
P = A.S.T.M. per cent evaporated at temperature of Td.

$P = \text{also, } \frac{100\ Rt}{Rv}$, where

Rt = Air-fuel ratio to carburetor.

To evaluate ease of starting, it is necessary to define the characteristics in terms of air-fuel and resultant air-vapor ratios. An air-fuel ratio of 1:1 is generally considered representative of actual conditions with the choke used at its maximum. Some disagreement exists as to when starting is just barely possible. Bridgeman and Cragoe defined[6] "possible" starting as taking place with a resultant air-vapor mixture of 20:1. According to Brown[3] a 20:1 resultant air-vapor ratio requires an infinite number of revolutions to obtain the first explosion and is impractical with the ordinary battery starter under cold weather conditions. He therefore defines "possible" starting as taking place under conditions yielding a 16:1 resultant air-vapor ratio, when 20 revolutions or less will cause the first explosion. Under present economic conditions this consideration is more or less academic, because practical-

[6]O. C. Bridgeman and C. S. Cragoe; An Intepretation of the A.S.T.M. Distillation Curves of Motor Fuels; Proceedings Eighth (December, 1927) annual meeting of the American Petroleum Institute, p. 54.



Figures 1 and 5—The average relationship between Reid vapor pressure and vapor locking tendencies is shown in Figure 1, upper left-hand corner. Figure 5, shows the operating characteristics of motor fuels.

[1]N. F. Le Jeune, H. M. Smith; eighth semiannual Motor Gasoline Survey, United States Bureau of Mines, Reports of Investigations, No. 2,525, September, 1923.

[2]G. G. Brown; The Volatility of Motor Fuels, University of Michigan, Engineering Research Bulletin No. 14, May, 1930.

[3]G. G. Oberfell and R. C. Alden; The "Front End" Volatility of Motor Fuels Since 1927; National Petroleum News, August 27, 1930.

[4]O. C. Bridgeman and E. W. Aldrich; The Properties of Gasoline with Reference to Vapor Lock; Journal of Society of Automotive Engineers, Vol. XXVII (July, 1930), p. 91.

[5]G. G. Brown; Discussion of reference 7.

ly all motor fuels are capable of "easy" starting.

"Easy" starting is defined[2,5] as taking place under those conditions which yield a resultant air-vapor ratio of 12:1, when 10 revolutions or less will cause the first explosion. With a 1:1 air-fuel ratio supplied to the carburetor the ability to provide "easy" starting is related to the A.S.T.M. distillation temperature at 8⅓ per cent evaporated. With a 2:1 air-fuel ratio "easy" starting is related to the 16⅔ per cent evaporated point, and so forth.

Figure 2 presents the relationships established by the above considerations, plotted on graph paper with the usual co-ordinates of the A.S.T.M. distillation. By plotting the A.S.T.M. distillation on Figure 2 with the distillation loss at the front end, the starting characteristics of the gasoline can be read from the intersections of the distillation curve with the several curves and axes. The points at which the distillation curve intersects the axes determine the minimum engine (atmospheric) temperatures for starting under the specified conditions. In determining the air-fuel ratios required for "easy" starting from the intersection of the distillation curve with the required engine (atmospheric) temperature curve, pass vertically to the sloping straight line and thence horizontally to the right hand scale designating the necessary air-fuel ratio.

An example is shown by the dotted curve in Figure 2, which represents the composite winter gasoline reported in the twenty-first semiannual motor gasoline survey of the United States Bureau of Mines.[2] The following tabulation lists the starting characteristics of this composite winter gasoline:

Minimum engine (atmospheric) temperature at which starting is barely possible with a 1:1 air-fuel ratio and a 20:1 resultant air-vapor ratio	—27° F.
Minimum engine (atmospheric) temperature at which easy starting can be obtained with a 1:1 air-fuel ratio and a 12:1 air-vapor ratio	—3° F.
Air-fuel ratio needed to provide easy starting at an engine (atmospheric) temperature of —30° F.	0.1:1
Air-fuel ratio needed to provide easy starting at an engine (atmospheric) temperature of 0° F.	1.6:1
Air-fuel ratio needed to provide easy starting at an engine (atmospheric) temperature of 30° F.	3.4:1
Air-fuel ratio needed to provide easy starting at an engine (atmospheric) temperature of 60° F.	5.6:1
Air-fuel ratio needed to provide easy starting at an engine (atmospheric) temperature of 90° F.	8.1:1

It is interesting to note that the air-fuel ratio required for "easy" starting is a measure of the degree of choking necessary to obtain the first explosion at the start. Consideration of the above tabulation regarding the composite national winter gasoline supports the statement made previously that practically all gasolines are easy starters.

Any conclusions in regard to actual ease of starting reached on the basis of the relationships presented here must necessarily be modified by the validity of the assumptions made. Starting is much more complicated than the simple premises would imply. Nevertheless, the use of these assumptions does permit a rational basis for comparison of this phase of motor fuel performance.

Blackwood and Rickles[3] have recently presented experimental data leading to the conclusion that characteristics of lubricating oils is of more importance than the volatility of the gasoline in cold starting. This is probably true with modern gasolines for the simple reason that practically all commercial gasolines are "easy" starters. The writer calls attention to the possibility that normal cold weather crankcase dilution may have a decided tendency to minimize the importance of lubricating oil characteristics as a factor in cold starting.

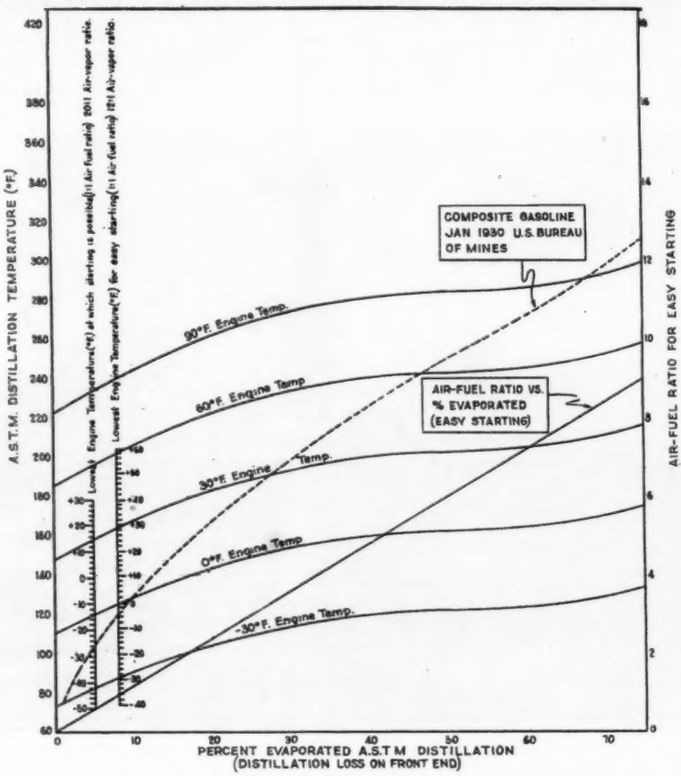

A.S.T.M. DISTILLATION TEMPERATURE (°F.)
AIR-FUEL RATIO FOR EASY STARTING
COMPOSITE GASOLINE JAN 1930 U.S. BUREAU OF MINES
90°F. Engine Temp.
60°F. Engine Temp
30°F. Engine Temp.
0°F. Engine Temp
-30°F. Engine Temp.
AIR-FUEL RATIO VS. % EVAPORATED (EASY STARTING)
PERCENT EVAPORATED A.S.T.M. DISTILLATION (DISTILLATION LOSS ON FRONT END)

Figure 2—The above graph shows starting characteristics under different conditions of temperature and air-fuel ratio.

Warming-Up Characteristics

The trend toward increased front end volatility of motor fuels[3] has to a large extent eliminated ease of starting as a problem of the motorist, engine designer and refiner. Practically all present day commercial gasolines are sufficiently volatile to provide easy starting except under the most extreme conditions. With the gradual elimination of this factor, the behavior of the gasoline during the first 10 minutes of operation has come under the closer scrutiny of the motorist.

The effective volatility of gasoline in the inlet manifold is dependent on the temperature therein and the vaporization characteristics of the gasoline. Brown[3] has related specifications for the A.S.T.M. 35 per cent evaporated temperature of the gasoline to the mixture temperature in the manifold according to the following formula:

$$Td = 100 + 1.5\,Te$$

He has further ascertained (Figure 78 of reference 2), the relationship between mixture temperature and time after starting. The former relationship has been confirmed at the higher atmospheric temperatures by Bridgeman and Aldrich.[7]

By correlating these two relationships it is possible to define by means of the A.S.T.M. distillation temperature at 35 per cent evaporated, the minutes after starting when the choke is no longer necessary. Such a relationship is shown in Figure 3 for five critical atmospheric temperatures.

To establish the relationship shown in Figure 3 it was necessary to assume in regard to Figure 78 of reference 2 that the highest maximum mixture temperatures were obtained when starting at the highest maximum atmospheric temepratures and vice versa. This assumption appears a rational one and was consequently applied to the aforementioned figure of the reference.

Figure 3 presents relationships for cars at both extremes in regard to temperatures maintained in the inlet manifold. At one extreme is found cars with automatic radiator shutters; efficient manifold hot spots and carburetors having efficient accelerating devices. At the other extreme are cars without radiator shutters, with less efficient manifold heating or with less efficient accelerating devices. In as much as the majority of automobiles are quite close to the latter classification the requirements of cars so equipped should receive most consideration in building motor fuels to seasonal quality specifications.

As was the case with ease of starting, the validity of Figure 3 is dependent on the validity of the assumptions upon which the figure is based. For purposes of comparison, the A.S.T.M. 35 per cent evaporated temperature provides a very satisfactory basis, although for the same 35 per cent temperature variations in the 65 per cent temperature will have some influence on the warming-up characteristics. However, because in the range of conventional endpoint automotive fuels the location of the 35 per cent point establishes the 65 per cent point quite definitely, this factor can be ignored except in extreme cases. It is also to be pointed out that enriching the mixture at the expense of economy would tend to place the emphasis earlier in the distillation curve than the 35 per cent point, and conversely.

Driving Conditions

Vaporization under steady driving conditions is apparent to the motorist as the maximum and minimum limits of atmospheric temperature at which good acceleration is possible. Crankcase dilution under steady driving conditions becomes a factor only when using gasolines with unusually high 90 per cent evaporated temperatures at unusually low atmospheric temperatures in cars not equipped with radiator shutters.

The lowest atmospheric temperature at which good acceleration is possible under steady driving conditions has been related to the 65 per cent evaporated temperature of the gasoline by Brown.[3] In his experiments he ascertained that a gasoline had to be about 65 per cent effectively volatile at the temperature in the inlet manifold to yield good acceleration. By means similar to those employed for "warming-up characteristics" the relationships presented by Brown have been converted to the form shown in Figure 4. The data of Figure 4, when applied to the 65 per cent evaporated temperature, establishes the minimum atmospheric temperature at which good acceleration is possible under steady driving conditions, after the engine has reached a temperature equilbrium.

In regard to the maximum atmospheric temperature at which good acceleration

(Continued on Page 216)

[2] E. C. Lane, E. L. Garton and O. C. Blade; twenty-first semiannual Motor Gasoline Survey; United States Bureau of Mines Reports of Investigations, No. 2,995; March, 1930.

[3] A. J. Blackwood and N. H. Rickles; Cold-Starting Characteristics of Automobiles; Journal of Society of Automotive Engineers, Vol. XXVIII (February, 1931), p. 234.

[7] O. C. Bridgeman and H. S. White; A Survey of Current Automobile and Bus Fuel Line Temperatures; annual meeting (January 20, 1931), Society of Automotive Engineers.

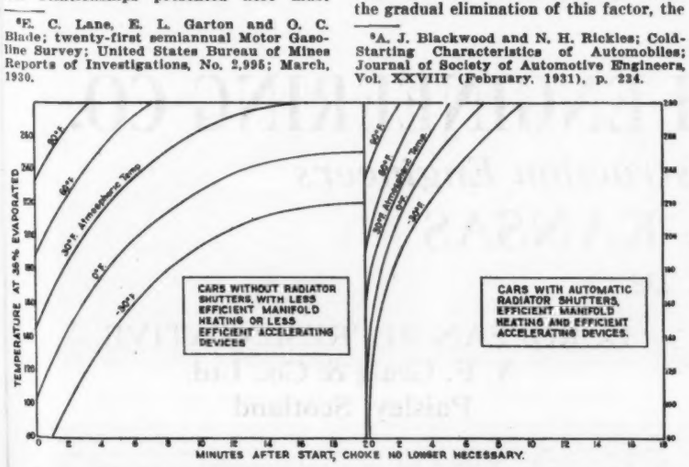

TEMPERATURE AT 35% EVAPORATED
90°F.
60°F.
30°F. Atmospheric Temp.
0°F.
-30°F.
CARS WITHOUT RADIATOR SHUTTERS, WITH LESS EFFICIENT MANIFOLD HEATING OR LESS EFFICIENT ACCELERATING DEVICES
CARS WITH AUTOMATIC RADIATOR SHUTTERS, EFFICIENT MANIFOLD HEATING AND EFFICIENT ACCELERATING DEVICES.
MINUTES AFTER START, CHOKE NO LONGER NECESSARY.

Figure 3—Warming up characteristic relationships of different types of automobiles are shown in the above graph. As most cars come under the classification on the left these characteristics should receive greatest consideration in building motor fuels.

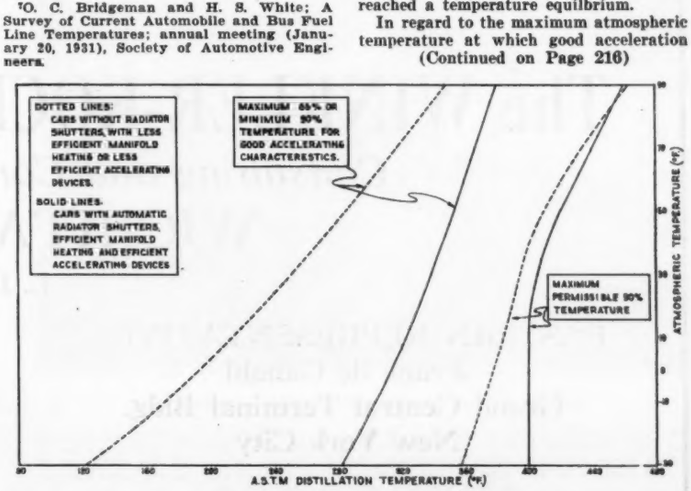
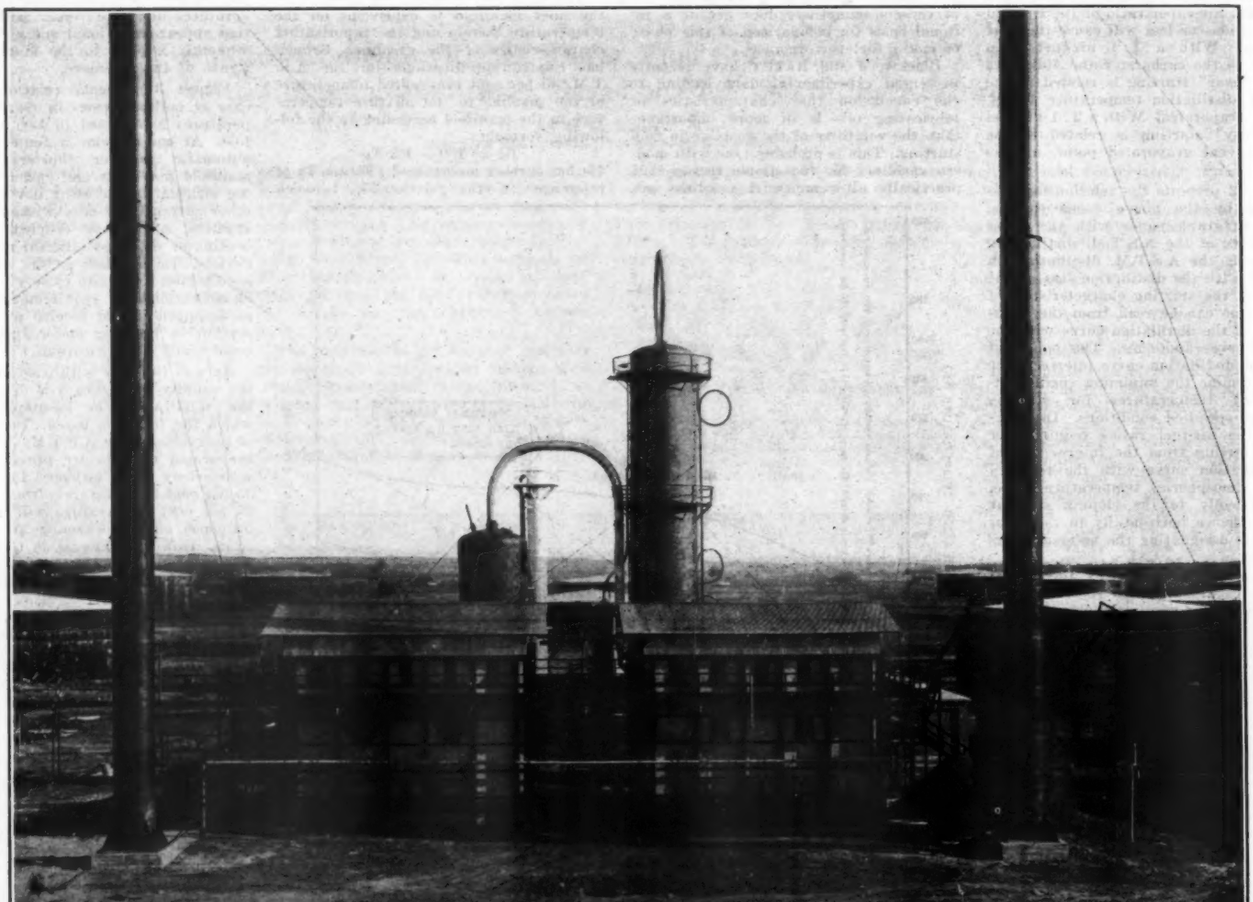

DOTTED LINES: CARS WITHOUT RADIATOR SHUTTERS, WITH LESS EFFICIENT MANIFOLD HEATING OR LESS EFFICIENT ACCELERATING DEVICES.
SOLID LINES: CARS WITH AUTOMATIC RADIATOR SHUTTERS, EFFICIENT MANIFOLD HEATING AND EFFICIENT ACCELERATING DEVICES
MAXIMUM 65% OR MINIMUM 90% TEMPERATURE FOR GOOD ACCELERATING CHARACTERISTICS.
MAXIMUM PERMISSIBLE 90% TEMPERATURE
ATMOSPHERIC TEMPERATURE (°F.)
A.S.T.M. DISTILLATION TEMPERATURE (°F.)

Figure 4—Vaporization under steady driving conditions.



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Molecular Structure and Knocking

Detonating Characteristics of Paraffin Hydrocarbons Cover Wide Range. Explain Three General Rules Applying to Properties

By T. A. Boyd
Research Laboratories, General Motors Corp.

That there are large differences in antiknock quality between fuels of different constitutions has been known for a long time. One of the very early observations made in studying fuels was that ethyl ether, $(C_2H_5)_2O$, (the ether used in the operating room) and butyl alcohol, C_4H_9OH, (one of the present lacquer solvents) differed greatly in antiknock quality. Ethyl ether was found to be a very badly knocking fuel, whereas butyl alcohol did not knock at all in any engine then available.

Now these two compounds have exactly the same chemical composition. That is to say, there are the same amounts of carbon, hydrogen, and oxygen in each. But they do not have the same structure or molecular makeup. By this it is meant that the unit bricks of carbon, hydrogen, and oxygen, although present in both in exactly equivalent numbers or amounts, are not put together in just the same way. Simply on account of this difference in make-up between ether and butyl alcohol, the former knocks badly and the latter does not knock.

In order to get specific and comprehensive information about the relationship between molecular make-up and antiknock quality, work was begun some years ago by Wheeler G. Lovell and John M. Campbell of the General Motors Research Laboratories in measuring the relative antiknock qualities of a large number of pure of individual compounds, hydrocarbons and derivatives of hydrocarbons. The compounds studied by these men have comprised hydrocarbons of the various paraffinic, olefinic aromatic, and naphthenic structures, as well as the different alcohols, acids, esters, ethers, and the like. As a result of these researches it is now possible to lay down some definite rules representing the relationships that exist between molecular makeup and antiknock quality.

Paraffin Hydrocarbons

From the viewpoint of gasoline, one of the most interesting classes of hydrocarbons is that called the paraffins. Paraffin hydrocarbons are probably present in nearly all gasolines, but perhaps they are present in highest concentration in straightrun Pennsylvania gasolines. It has therefore been supposed that hydrocarbons of paraffinic structures are uniformly of low antiknock quality. But the results obtained by Lovell and Campbell show that this is an erroneous belief. Paraffin hydrocarbons of some types of structure have excellent antiknock qualities indeed. (For the detailed results obtained by Lovell and Campbell see Industrial and Engineering Chemistry, January, 1931, p. 26.) Here are the principal rules that they have found paraffin hydrocarbons to follow in respect to relationship between molecular structure and antiknock quality.

The first of the rules is that paraffin hydrocarbons of straight-chain structure show a regular and rapid decrease in antiknock quality as the length of the carbon chain (or the molecular size) increases. Thus normal pentane, having five carbon atoms in a straight chain, is about like a regular gasoline in tendency to knock, but the corresponding heptane (seven carbon atoms in a row) is a very violent knocker, and the straight-chain nonane (nine carbon atoms in a row) is much worse still.

Research building of the General Motors Research Corp., located at Detroit, Mich.

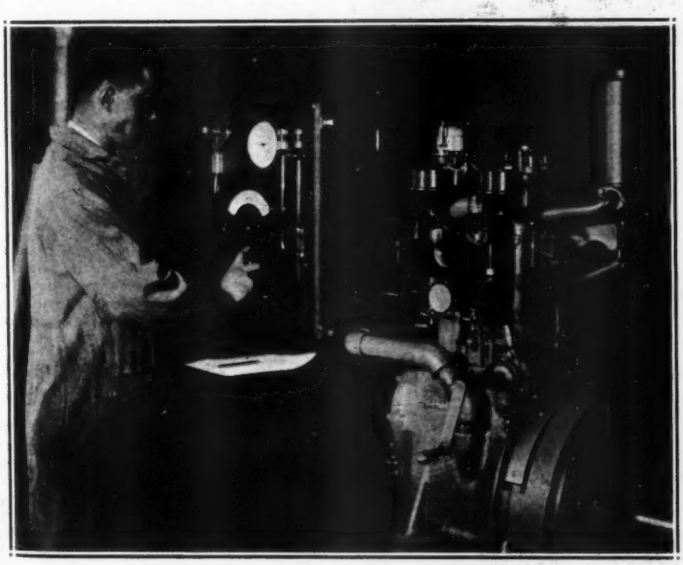
The second rule observed for paraffin hydrocarbons is that, for a carbon chain of given length, antiknock quality is improved as the number of methyl groups added to the chain in the form of side members is increased. Antiknock quality goes up by a substantially constant increment for each additional methyl group added. This improvement takes place in spite of the fact that each additional methyl group added as a side member increases the molecular size or the total number of carbon atoms in the molecule.

The third rule is that for paraffin hydrocarbons of a given molecular size, or of a definite number of carbon atoms in the molecule, antiknock quality is improved or tendency to knock gets less as what might be loosely termed the centralization of the molecule is increased. Take, for instance, the case of the heptanes. There are nine different heptanes, each with a different structure or arrangement of the seven carbon atoms in the molecule. Antiknock quality of these nine heptanes goes up by stages from that of the straight-chain compound normal heptane, which is the worst of the heptanes, to that of the heptane having the closest possible centralization of its seven carbon atoms, which is accordingly the best of the heptanes. This range in antiknock quality is a very wide one. How wide it is may be seen from the figures presented in the second paragraph following.

These three rules give the way the gasoline engine classifies the paraffin hydrocarbons, for all the determinations of antiknock quality upon which they are based were made directly in an engine. The engine makes its classifications definitely and with greater certainty than an organic chemist can do it, which only goes to show that the gasoline engine is a chemist, and a very discriminating one.

What the differences in antiknock quality for the heptanes, just mentioned, amount to in a practical way may be seen from the following facts. To run on a fuel consisting of normal heptane alone, an automobile engine would need to have a compression ratio not higher than 3 to

(Continued on Page 227)



ENGINE AND INSTRUMENTATION USED FOR KNOCK STUDIES

All determinations of the relationship between molecular makeup and antiknock quality were made directly in an engine. The gasoline engine is the best tool for such a study, for the result obtained is a direct one and the engine happens to be very sensitive to slight changes in the molecular makeup of the fuel it runs on. The engine can detect differences in chemical structure between fuels more quickly and with greater certainty than a human chemist can. Knock is the language in which the engine reports its findings.

SYNTHESIZING HYDROCARBONS FOR KNOCK STUDIES

Most of the paraffin hydrocarbons used in the work of Lovell and Campbell were made in the laboratory. Laboratory synthesis is a difficult way to make an engine fuel, and an expensive one. But in this research it was necessary to make almost all of the hydrocarbons used, because synthesizing a hydrocarbon was the only way to be sure that it had the exact chemical structure desired.

Sulphur Compounds in Light Oils

Accurate Knowledge of Characteristics and Relationship to Refinery Processing Necessary as Basis for Removal

By F. C. Parris
Chief Chemist, Hercules Gasoline Co., Ltd.

The ultimate object in treating light oils and gasoline stocks for the market is to free them from undesirable compounds in order to meet certain specifications for each particular product. The chief undesirable substances are compounds of sulphur, some of which are very complex and difficult to remove. Others are simple in nature and can be removed readily. Some of the complex sulphur compounds can be changed into simpler ones and then eliminated; others can be changed in nature but remain in solution or are removed in another stage of treatment.

All crude oils contain some compounds of sulphur and an effective treatment depends upon the knowledge of these compounds as they occur in different stages of refining from crude to finished product. It may be said, generally, that the higher the percentage of total sulphur in the oil the more rigid the treatment the stocks must be given in order to meet standard requirements.

Fundamental Factors

Some of the fundamental factors affecting the refining of light oil stocks are outlined as follows:

(a) Factors affecting treatment.
Object of treatment.
Source of raw stock (crudes, distillates, etc.).
Percentage of total sulphur.

(b) Distillation.
Distillation range.
Type of apparatus.
Operation and control.

(c) Nature of undesirable compounds.
Classification (molecular structure, etc.).
Reagents employed and costs.
Time required for treatment.
Temperatures of treatment.

The methods of distillation and distillation range play an important part in the treatment of the various products made. Skillful operation, control and type of fractionating apparatus are essential in the treating process. Obsolete methods of distillation usually require greater amount of treatment than latest methods. The elapse of time between distillation and treatment is also a factor. Cracked stocks differ materially from straightrun stocks in their treatment.

Nature of Undesirable Compounds

Hydrogen sulphide: A general classification of the organic sulphur compounds found in gasoline and naphtha stocks, or formed during their treatment, follows:

Hydrogen sulphide, H_2S.
Mercaptans, R*-S-H.
Alkyl sulphides, R-S-R.
Di-sulphides (thio-ethers), R-S-S-R.
Thiophenes, C_4H_4S.
Free sulphur, S.
Sulphones, $R\text{-}SO_2\text{-}R$.
Sulphonic acids, $R\text{-}S{<}\begin{matrix}O\\OH\end{matrix}$
Sulphoxides, R-SO-R.

*R denotes any alkyl radical, forming with each compound a series within itself, viz., ethyl mercaptan = C_2H_5SH.

Hydrogen sulphide is the simplest of the series and yet one of the most undesirable sulphur compounds, due to its highly corrosive action. It is either present in the crude and distilled over, or formed by decomposition or cracking of other higher molecular weight compounds during distillation. It attacks the refinery equipment throughout, as well as being poisonous to the workmen and should be neutralized as soon as possible.

Hydrogen sulphide is sometimes formed during certain stages of treatment, especially during sour washes and acid treatments, etc. Its contact with sulphuric acid is shown by the equation:

$$S{<}\begin{matrix}H\\H\end{matrix} + \begin{matrix}HO\\HO\end{matrix}{>}SO_2 = 2H_2O + SO_2 + S,$$

forming free sulphur which dissolves in the oil, thereby increasing the sulphur content. Hydrogen sulphide is removed by weak caustic soda, sodium carbonate, or ammonia, etc. Its presence in the oil, however, may be utilized in affecting removal of other sulphur compounds at certain stages of treatment, and its relationship to other compounds with certain reagents will be discussed.

Mercaptans and Thiophenols

The mercaptans may be regarded as sulphur or thio-alcohols, in which the oxygen in the hydroxyl radical is replaced by sulphur, i.e.:

$C_2H_5\text{-}OH$	$C_6H_5\text{-}OH$	C_2H_5SH
Ethyl alcohol	Phenol	Ethyl mercaptan

C_6H_5SH
Thio-phenol

They are liquids or gases of intolerable odor (garlic) and are insolube in water. The lower mercaptans are soluble in caustic alkali solutions. They form well crystallized mercuric mercaptides of definite melting point and lead mercaptides with a yellow color. The lower mercaptans have a greater tendency toward corrosion and react readily with sodium plumbite solution or with sulphuric acid. The higher ones react more slowly with sodium plumbite solution and are termed as sour. Their tendency toward corrosion (copper strip) is less than the lower mercaptans, but the action of each class upon doctor solution (sodium plumbite test) is termed positive. The reactions of mercaptans with some ordinary reagents used in their treatment are:

With sulphuric acid:

$$R\text{-}S\text{-}H + \begin{matrix}H\text{-}O\\H\text{-}O\end{matrix}{>}SO_2 = \begin{matrix}R\text{-}S\\H\text{-}O\end{matrix}{>}SO_2 + H_2O \quad (1)$$

$$R\text{-}S\text{-}H + \begin{matrix}R\text{-}S\\H\text{-}O\end{matrix}{>}SO_2 = \begin{matrix}R\text{-}S\\R\text{-}S\end{matrix}{>}SO_2 + H_2O \quad (2)$$

$$\begin{matrix}R\text{-}S\\R\text{-}S\end{matrix}{>}SO_2 + \text{Heat} = \begin{matrix}R\text{-}S\\|\\R\text{-}S\end{matrix} + SO_2 \quad (3)$$

This reaction performed in three stages explains its relationship with the action of H_2SO_4 on hydrogen sulphide. Water and sulphur dioxide are formed in each case—and free sulphur formed in the case of hydrogen sulphide.

With sodium plumbite (doctor) solution:

$$\begin{matrix}R\text{-}S\text{-}H\\R\text{-}S\text{-}H\end{matrix}{>} + \begin{matrix}Na\text{-}O\\Na\text{-}O\end{matrix}{>}Pb = \begin{matrix}R\text{-}S\\R\text{-}S\end{matrix}{>}Pb + 2NaOH \quad (1)$$

Lead mercaptide

$$\begin{matrix}R\text{-}S\\R\text{-}S\end{matrix}{>}Pb + S = \begin{matrix}R\text{-}S\\|\\R\text{-}S\end{matrix} + Pbs\downarrow \quad (2)$$

Hydrogen sulphide with doctor solution:

$$S{<}\begin{matrix}H\\H\end{matrix} + \begin{matrix}NaO\\NaO\end{matrix}{>}Pb = Pbs\downarrow + 2NaOH$$

Copper oxide with mercaptans:

$$\begin{matrix}R\text{-}S\text{-}H\\R\text{-}S\text{-}H\end{matrix} + CuO = \begin{matrix}R\text{-}S\\R\text{-}S\end{matrix}{>}Cu + H_2O \quad (1)$$

$$\begin{matrix}R\text{-}S\\R\text{-}S\end{matrix}{>}Cu + CuO = \begin{matrix}R\text{-}S\\|\\R\text{-}S\end{matrix} + Cu_2O \quad (2)$$

Sodium hypochlorite (NaOCl) on mercaptans:

$$\begin{matrix}R\text{-}S\text{-}H\\R\text{-}S\text{-}H\end{matrix} + O{<}\begin{matrix}Na\\Cl\end{matrix} = \begin{matrix}R\text{-}S\\|\\R\text{-}S\end{matrix} + NaCl + H_2O$$

On hydrogen sulphide:

$$S{<}\begin{matrix}H\\H\end{matrix} + O{<}\begin{matrix}Na\\Cl\end{matrix} = NaCl + H_2O + S$$

The sweetening action of the reagents used above are principally the same in each case, i.e., the mercaptans are converted to di-sulphides which do not show a positive doctor test and have not an unpleasant odor.

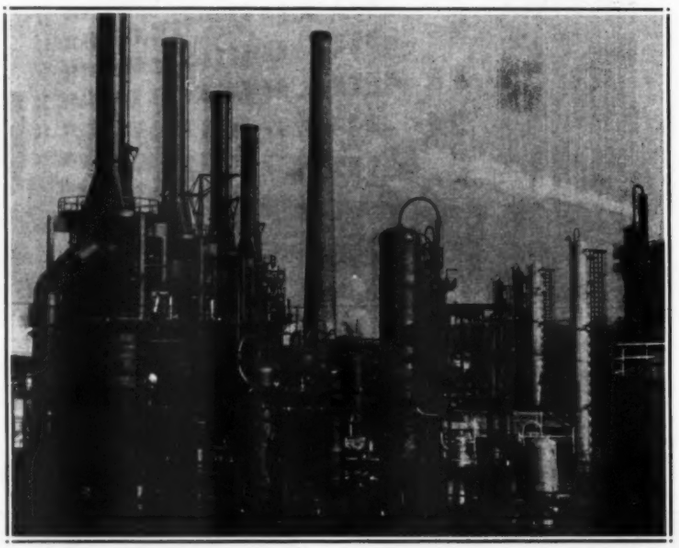
Di-sulphides $\begin{matrix}R\text{-}S\\|\\R\text{-}S\end{matrix}$

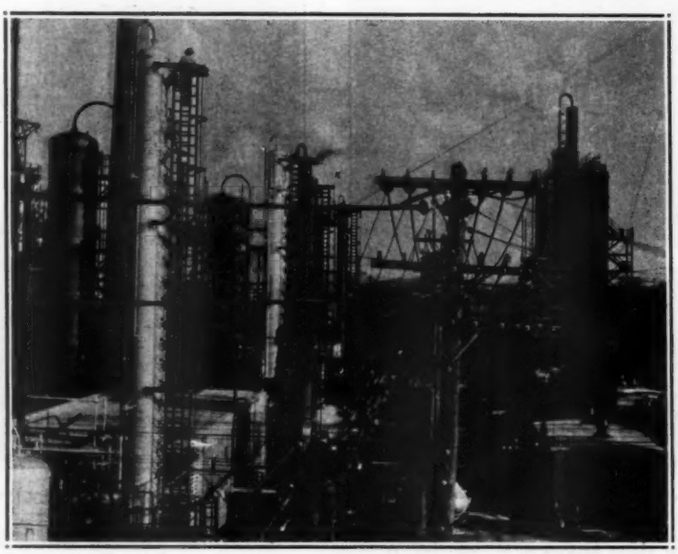
Since the di-sulphides are formed from the corresponding mercaptans, they are relatively insoluble in aqueous solutions of reagents forming them and therefore go back in solution in the oil. Hence, the mercaptan sulphur content is not appreciably lowered. They are sparingly soluble in sulphuric acid. They form addition products with aluminum chloride, and sodium sulphide is thought to remove them at high temperatures.

Alkyl Sulphides or Thio-ethers

These compounds occurring in petroleum oils possess a powerful garlic odor,

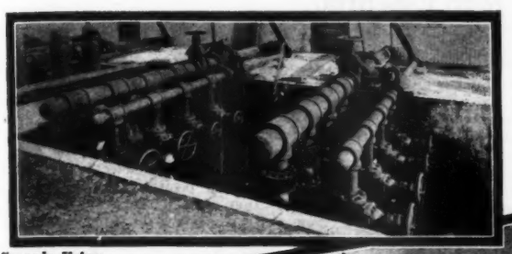
(Continued on Page 168)





Views of deFlores cracking installation at Point Breeze, Pa., refinery of the Atlantic Refining Co.

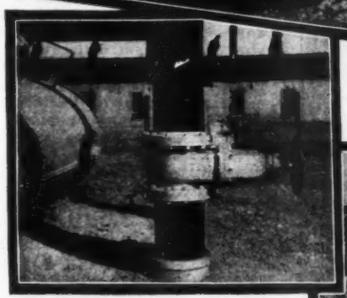
Valves for every oil industry service



Kennedy Valves at manifold of tank farm.

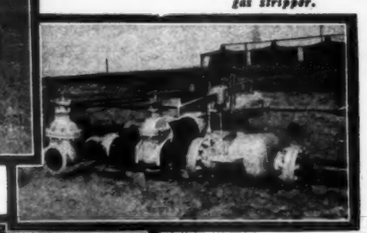
Kennedy Valves at pumping station.

Kennedy Valves on high pressure pumping service.

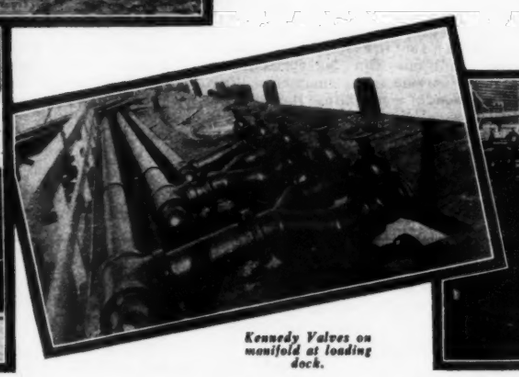


Kennedy Valves at gas lift station.

Kennedy Valves on gas stripper.



Kennedy Valves in compressor room.



Kennedy Valves on manifold at loading dock.

IN oil and gas fields, refineries, pump houses, and on oil pipe line systems, Kennedy 400-lb., 700-lb., 1000-lb. and 1600-lb. test Gate Valves have a wide application.

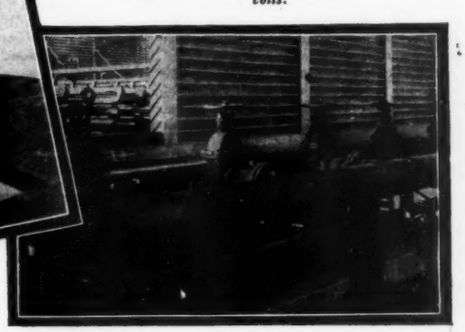
Their heavy proportions, sound, strong metal, large disc-seating surfaces, unobstructed full opening, provisions for maintaining position of seat rings, gaskets, and packing, and perfect seating of disc are some of the features that assure efficient, trouble-free operation.

There are many economies in standardizing on Kennedy Valves—economy in cost, for Kennedy Valves are reasonably priced; economy of time and labor, for they operate easily and with positive action; economy of power, for their wide unobstructed passages reduce friction losses to a minimum; and economy of maintenance, for they can be depended upon for many years of trouble-free service.

Other Kennedy products for the oil industry include standard, extra-heavy and extreme-pressure globe, angle and gate valves, malleable iron screwed fittings and cast iron flanged fittings. These products are fully described and listed in the Kennedy Catalog, which will be sent on request.

The Kennedy Valve Mfg. Co.,
Elmira, N. Y.

Sales offices in principal oil centers



Kennedy Valves on manifold of cooling coils.

KENNEDY

VALVES-PIPE FITTINGS-FIRE HYDRANTS

Reducing Fire Losses to Minimum

Care in Laying Out Plant Prevents Spread of Flames. Modern Fighting Equipment and Trained Men Essential

By F. L. Wallace
The Texas Company

In the operation of refining, storing and transferring of inflammable liquids and gases, many hazards are present that can be encountered safely when due consideration is given first towards prevention, second, restriction and segregation, and third, effective means of combating fires after starting.

Since heat plays such an important part in the refining operation and consists of one of the largest single items of cost, it becomes necessary from an economical standpoint to use the products of combustion direct on surfaces to be heated. Further, inflammable liquids are heated to temperatures where they flash into flame spontaneously when coming into contact with the atmosphere.

Since the possibility of fire when handling inflammable products is such common knowledge, it affords little excuse for the lack of care taken in the prevention of fires. Investments made in equipment and layout affording security against known hazards pay good dividends. Under the subject of prevention, probably the most important consideration is the location of the equipment. Quite often the conservation of ground space proves costly in the end. Adequate room allows for proper construction and inspection of apparatus. The selection of materials and type of construction used provide the factor of safety in the prevention of fires.

After the best materials have been selected and the construction best suited for the requirements has been used, the next step in security is thorough and regular inspection of all operating equipment. The length of time between inspections and tests depends entirely upon the nature and deterioration of materials used in the construction. Under no condition should the period be such that the rate of deterioration will reduce the factor of safety of any portion to a dangerous point. Periodic inspections will forecast the life of equipment so that their frequency can be determined from this information.

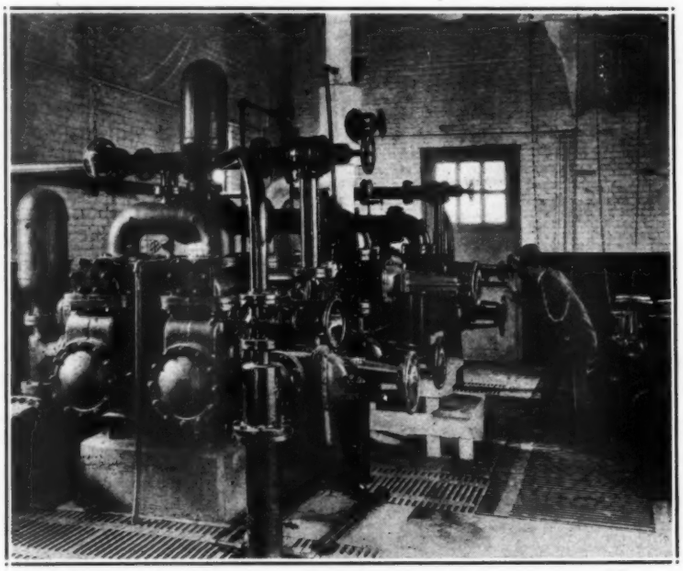
After concentrated effort has been expended along lines of prevention of fires, it then becomes necessary to assume a rather pessimistic viewpoint and consider each piece of equipment in view of a possible failure. Visualize the failure of materials at different locations and immediately one's thoughts turn to the restriction of the fire to a localized part of the unit or plant without danger of spreading to surrounding parts, causing their failure due to external heat applied from the fire. Means of restricting a fire to a localized part of a unit or to a section of several units will afford easy means of combating a fire and reduce the material damage to the lowest possible figure.

Drainage System

Probably the most prevalent cause of fires spreading in plants, regardless of size, comes from the drainage system, in case careful means have not been provided for restriction and segregation. The fact that water runs down hill and that oil floats on water, and further, the fact that fire travels with the oil, makes a combination that requires mechanical means of control. Covered ditches and sewers, improperly sealed, provide an easy access for fire spreading. All of these conditions can be corrected by means of surface seals, smothering lines, and method of controlling the direction of flow.

If fires could be prevented entirely, it would not be necessary to consider means to restrict or segregate them to a limited area so that they can be combated successfully. Since the human and material element, however, play such an important part in the construction, operation, and inspection of equipment, there are fires. Consequently, adequate means must be provided to combat fires.

The organization and equipment for fighting fires would pay its largest dividends if there was never a need for it to be put into use. On the other hand, when the need does arise its effectiveness will be in proportion to its training and the selection of proper equipment to use in combating the fire.



Stationary Foamite pumper capable of delivering 1,042 gallons per minute.

Any plant, large or small, needs the services of an efficient fire fighting organization. The oil industry in particular, due to the nature of its hazards, usually has its own organization. The structure of the organization can be composted of men in this service exclusively, or built up of operating men assigned to various duties about the plant. The size and extent of such an organization will depend entirely upon the amount of equipment and area covered. In a large refinery, covering several miles of operating equipment, it becomes necessary to have a large organization, consisting of men specially trained to meet the various hazards involved. A very satisfactory organization can be made of operating personnel selected from various operating positions. This permits the selection of men that can be spared from their respective duties when called. It also allows a 24-hour organization, irrespective of individual. Such a unit company comprises a part of a larger organization composed of similar companies. This method has the outstanding feature that in case of a fire in any particular area, a company trained in using equipment is available and entirely familiar with the operating equipment involved. The promptness with which fire fighting equipment is used often confines what might develop into a large fire to one of small damage.

Fire Alarm System

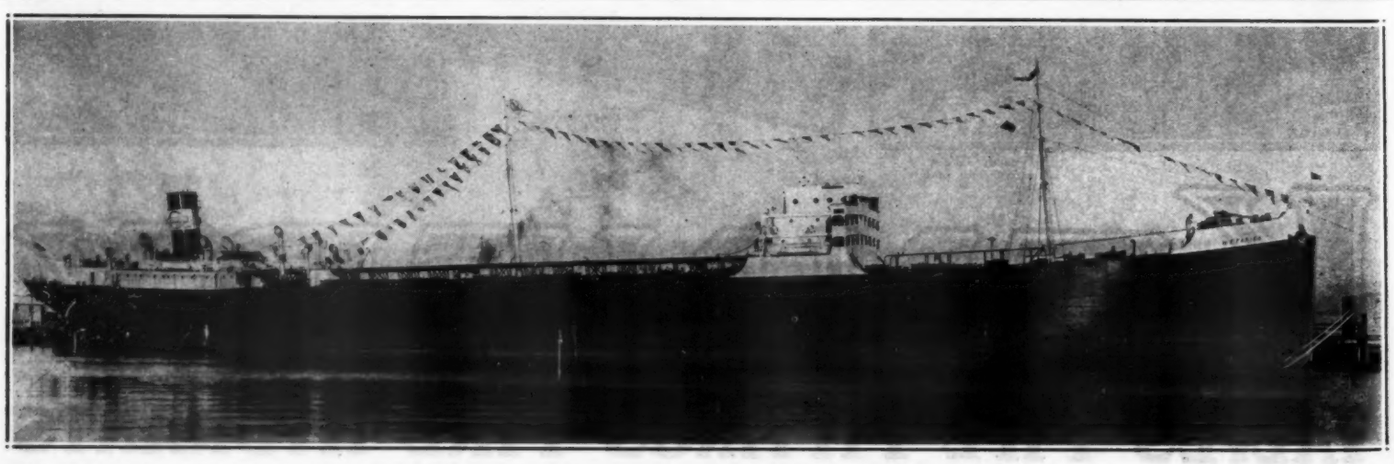
In a large plant, a fire alarm system must be used to designate the location of the fire in order to summon all companies required. This also offers a warning to operaitng men who man water and chemical pumps, etc., to stand by and operate such equipment.

Everyone realizes the effectiveness of such an organization will depend upon the training of the personnel. A company usually consists of 5 to 9 men, the number of companies depending upon the size of the plant. Regular fire drills must be held to keep personnel trained in the art of using fire fighting equipment and particularly learning the location of fire fighting equipment and familiarity with operating units. If this latter feature is omitted, any organization will work under a handicap.

The fire chief in charge of the organization is not only responsible for the training of the men in his companies, but his duties carry another responsibility that is as great if not greater, that is the constant inspection and maintenance of the fire fighting equipment. Due to infrequent use and dependence placed upon fire fighting equipment, inspection is necessary at frequent intervals. Many a fire extinguisher is kept polished for appearance's sake on the wall of a building for years and yet would be entirely ineffective for extinguishing a fire. In fact, some fire extinguishing chemicals are correspondingly good for cleaning solvents and they find their way into that use instead of fighting fire.

A fire fighting organization of well

(Continued on Page 225)



The "W. S. Farish" one of the tankers of the Standard Shipping Co. at the Baytown, Tex., docks of the Humble Oil & Refining Co., on its maiden voyage. The tanker has a capacity of 140,000 bbls. and is one of the largest in oil service.

Characteristics of Hydrogen Sulphide

This Dangerous Poisonous Gas Has Presented Many Difficulties in Production and Refining of Petroleum

By C. K. Francis
Technical Editor

A TROUBLESOME SUBSTANCE

Hydrogen sulphide is found widely distributed in nature and is produced by the decomposition of many organic and mineral substances.

It is a dangerous poison. It is the foundation of a series of different kinds of corrosive sulphur compounds, which cause extensive damage, and is responsible for many mechanical failures in the petroleum industry.

The properties of hydrogen sulphide, when understood, explain numerous fires, explosions, and chemical problems met in the handling of natural gas and the refining of petroleum.

Hydrogen sulphide, often referred to by its chemical formula, H_2S, is a gas that is widely distributed in nature. It is found in the gas issuing from volcanoes; dissolved in certain spring waters, called sulphur waters; in some swamp gas; frequently in natural gas and certain petroleums. Its presence is indicated in decaying vegetable and animal matter, especially such material containing high percentages of sulphur, by the characteristic odor. The gas is noted about tanneries, glue factories, rendering plants, smelters, and in sewage. According to Taylor[1] the sewer gas of Paris has contained 2.99 per cent hydrogen sulphide. Many organic substances when heated will give off hydrogen sulphide as one of the decomposition products. The gas will frequently be evolved from petroleum while in storage and when it is heated during the refining process. It may be held in solution in the oil to be released upon standing, or when heated; additional quantities may be produced from the sulphur compounds present in the oil. Some refinery gases contain large quantities of hydrogen sulphide but its presence in such uncondensed gas depends on the character and quantity of the sulphur compounds present in the petroleum that is being refined.

Constants

The physical constants of hydrogen sulphide are shown in the table:

Table 1—Hydrogen Sulphide Physical Constants

Normal state	Gas
Formula	H_2S
Molecular weight	34.08
Specific gravity,	
air = 1	1.1906
water = 1	0.9
Cubic feet/lb.	11.0
Weight/cu. ft. (lb.)	0.0909
Melting point	—119°F.
Boiling point	— 76°F.
Specific heat, constant pressure	0.2423
Critical temperature	212.7°F.
Critical pressure	92 atmos.

Hydrogen sulphide may be liquefied at ordinary temperatures under a pressure of 250 pounds. The liquid boils at minus 76° F., and becomes solid at minus 119° F. The gas is soluble in cold water in the ratio of four volumes of the gas to one of water. The water solution has an acid action when tested with litmus paper, which indicates the acid character of the gas.

The solubility of hydrogen sulphide has been determined as follows:

One volume of water at	
0°C. or 32°F. absorbs	4.37 volumes H_2S
15°C. or 59°F. absorbs	3.23 volumes H_2S
25°C. or 77°F. absorbs	2.61 volumes H_2S
40°C. or 104°F. absorbs	1.86 volumes H_2S

Hydrogen sulphide is very soluble in water as evidenced by the fact that 59° F. water dissolves 3.23 times its volume of the gas. Most crude oil is in contact with water and the solubility of hydrogen sulphide in water probably explains the fact that many crude oils are free from hydrogen sulphide.

In water solutions hydrogen sulphide is dissociated to a slight extent with the formation of hydrogen ions, therefore, behaving as a weak acid. This acid is known as hydrosulphuric acid. It possesses the usual properties of the acids in that it turns blue litmus to red and neutralizes bases. The common products are the sulphides and the acid sulphides.

Explosive

Hydrogen sulphide is slightly heavier than air, specific gravity 1.1906, is inflammable, burning with a blue flame. When it burns it unites with the oxygen of the air to form sulphur dioxide. It is completely converted to water and sulphur dioxide when there are two volumes of hydrogen sulphide and three volumes of oxygen. When these conditions exist and an electric spark is introduced into the mixture a violent explosion results.

$$2\,H_2S + 3\,O_2 \rightarrow 2\,SO_2 + 2\,H_2O$$

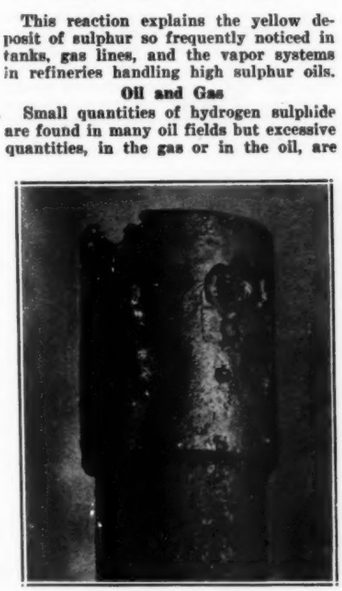
In the presence of a small quantity of air there will not be enough oxygen to complete this reaction. Then free sulphur will be deposited according to the next reaction.

$$2\,H_2S + O_2 \rightarrow 2\,H_2O + 2\,S$$

This reaction explains the yellow deposit of sulphur so frequently noticed in tanks, gas lines, and the vapor systems in refineries handling high sulphur oils.

Oil and Gas

Small quantities of hydrogen sulphide are found in many oil fields but excessive quantities, in the gas or in the oil, are met with in a comparatively few pools. Northern Mexico, Kentucky, Ohio, Ontario, Illinois, Gulf Coast and the Texas plains are the prominent sulphide districts. The Illinois gas has contained 1.2 per cent, Mexico 1 per cent, Ontario 0.6 per cent, Kentucky 1.5 per cent.



Corroded coupling from well, Crane County, Texas.

It is reported that hydrogen sulphide is present in practically all of the gas found in the Panhandle area of Texas, and that some of the wells produce a gas which contains over 15 per cent of this objectionable gas. The gas from the "granite wash" formation in this area contains the smaller quantities, in fact the percentage of hydrogen sulphide in this gas may be considered negligible from the safety standpoint.[3] Larger percentages are found in the oil and gas from the "lime" wells. There appears to be a quite distinct segregation of the gas containing dangerous and objectionable concentrations of hydrogen sulphide. The gas from the "granite wash" and that from the "big gas" stratum was free from the odor of hydrogen sulphide and, when tested quantitatively, appeared to contain less than 0.01 per cent.

Texas

There is a wide variation in the hydrogen sulphide content of the gas produced in Winkler County, Texas. The analyses show hydrogen sulphide from 0.6 per cent to 6 per cent by volume in the gas from the Hendricks Pool.

TABLE 2—HYDROGEN SULPHIDE CONTENT OF NATURAL GAS

Source of gas—	Grains of H_2S per 100 cu. ft. of gas*	H_2S content per cent by volume
Texas:		
Crane-Upton	5,080–7,610	8.0 –12.0
Big Lake	5,150–6,670	8.1 –10.5
McCamey	3,180	5.0
Panhandle	127- 950	0.2 – 1.5
Pennsylvania—		
Lower Oriskany	508	0.8
Ohio:		
Findlay—Fostoria	95– 133	0.15– 0.21
Kenton	250	0.39
Indiana—		
Muncie—Kokomo	95– 127	0.15– 0.20
Kentucky—Glasgow	1,840	2.9
Illinois:		
Olney	762	1.2
Casey	540–1,525	0.85– 2.4
Canada:		
Tilbury Field	400– 450	0.63– 0.71
Alberta—Calgary	92– 650	0.15– 1.0
Point Albino	470	.074

*A concentration of 1 per cent by volume of H_2S in the gas is equivalent to 635 grains of H_2S per 100 cubic feet of gas.

There is little information available about the composition of the gas from Lea County, New Mexico. However, there appears to be considerable hydrogen sulphide in the gas and it is reported to have the same general characteristics as that found in the adjacent territory of the Panhandle of Texas.

Frequently the fresh oil contains hydrogen sulphide but it soon disappears when stored in contact with air or if the oil is slightly warmed. Blowing air through the oil or steaming will aid in its removal.

Sulphur is present in petroleum and natural gas in two forms; that is, inorganic and organic. Practically all of the inorganic sulphur is in the form of hydrogen sulphide, occasionally small quantities of the sulphates may be detected in petroleum. The sulphur of natural gas is essentially hydrogen sulphide with not much more than a trace of the organic sulphur represented by the lower mercaptans. The reason for this is the mercaptans have physical properties that will not permit great diffusion or solubility in natural gas. The lowest mercaptan, methyl mercaptan, CH_3SH, is comparatively heavy with a specific gravity 0.8961, or 26.4 A.P.I., and its boiling point is relatively high, 45° F. The next higher mercaptan, ethyl mercaptan, is somewhat lighter, but its boiling point is even higher, 95° F.

Refinery Gas

During the refining of some of the high sulphur crude oils the quantity of the sulphur in the gases produced probably equals that of the very bad natural gases. Extensive data on the sulphur content of both petroleum and natural gas, Tables 2 and 3, were presented by D. L. Jacobson in The Oil and Gas Journal.[2] Large quantities of hydrogen sulphide are evolved when refining Mexican petroleum, the sulphur content of the uncondensed gases ranging from 600 to 3,000 grains of hydrogen sulphide per 100 cubic feet of the gas. Other refinery gases were shown to contain 600 to 1,200 grains pre 100 cubic feet, or from 0.95 to 1.9 per cent; 100 to 1,000 grains and up to 7,610 grains per 100 cubic feet, (12 per cent by volume), being reported.

While these large quantities of hydrogen sulphide have been detected in the gases, the total quantity of organic sulphur has not exceeded 8 grains of sulphur per 100 cubic feet of gas, according to Jacobson. This small quantity may be considered negligible when compared with the percentage of hydrogen sulphide.

TABLE 3—SULPHUR CONTENT OF PETROLEUM

Source of petroleum—	Total sulphur per cent
Texas:	
Crane-Upton	1.00 to 2.50
Big Lake	0.4
Panhandle	0.50
Winkler County	1.49 to 2.07
Pecos	2.27
California	0.34 to 3.55
Oklahoma and North Texas	0.40
Pennsylvania	0.09
Ohio—Lima	0.65
Indiana—Lima	0.48
Kentucky	0.12 to 0.49
Illinois—Eastern	0.24
Canada	Up to 1
Mexico	Up to 5.3

Use

A valuable use for hydrogen sulphide is as a reagent for use in chemical analysis, because a number of the metals are precipitated as sulphides from their solutions. This may be illustrated by treating a solution of copper sulphate in water with hydrogen sulphide.

$$CuSO_4 + H_2S \rightarrow CuS + H_2SO_4$$

The copper sulphide may be easily separated by filtration and then identified by appropriate chemical tests.

Swamp Gas

The presence of marsh gas and hydrogen sulphide in swamps has been suggested as an indication of natural gas and possibly petroleum deposits. However the facts do not support this idea. Marsh gas is another name for methane, CH_4, the lowest member of the straight chain, or paraffin, hydrocarbons, and the predominating constituent of natural gas. Hydrogen sulphide is found in some natural gas but it is not present in all natural gas. Both of the substances are produced when organic matter decomposes, and this fact explains their presence in swamps.

Hydrogen sulphide is easily detected by its bad odor; marsh gas has no odor and burns freely with no appreciable odor. Hydrogen sulphide does not burn so freely and its flame gives off the odor of burning sulphur, sulphur dioxide. True natural gas is usually found under conditions that indicate a source of pressure, and any natural gas seepage may cover considerable ground. The flow of natural gas from a spring is usually quite uniform while a marsh gas deposit must be dislodged by means of stirring the mud by some means, such as a stick.

The mere presence of either of the gases in a swamp is of no significance as an indication of natural gas or pe-

[1] Medical Jurisprudence, 486.

[2] April 4, 1929, page 116.

[3] Yant and Fowler, Hydrogen Sulphide Poisoning in the Texas Panhandle, Big Lake, Tex., and McCamey, Tex., oil fields. Report of Investigations No. 2,776, October, 1926, U. S. Bureau of Mines.

troleum deposit because both gases are natural products of the decomposing vegetable matter.

Preparation

It may be prepared by the action of an acid on a sulphide, as illustrated by treating iron sulphide with hydrochloric acid:

$$FeS + 2\,HCl \rightarrow FeCl_2 + H_2S$$

The paraffin hydrocarbons have a great affinity for sulphur. This is demonstrated by the vigorous reaction that takes place when petrolatum, or even solid paraffin, and sulphur are heated together.[4] This may be used as a convenient method for prepaxing hydrogen sulphide. According to Friedmann, the liquid homologs behave similarly if they are heated under pressure above their boiling points. Large quantities of hydrogen sulphide are split off, and even at temperatures between 482° and 572° F. the reaction proceeds so far that pronounced coking of the hydrocarbons takes place.

Odor

The characteristic odor of hydrogen sulphide, so noticeable in a rotten egg, is usually enough to show its presence, but some gases, such as refinery gas, may contain other substances that will mask this odor. The usual qualitative test is made with a solution containing 5 per cent of lead acetate. A drop or two of this solution is dropped on a piece of filter paper which is placed in the gas and in the presence of hydrogen sulphide the moistened portion of the paper will gradually turn brown and finally black. The same test may be used when examining a solution by suspending the paper above the liquid while it is being heated.

The action of hydrogen sulphide on metals is to form the sulphides. This is the cause of silver tarnishing, becoming brown to black, when exposed to the gas and when gas containing hydrogen sulphide is burned in dwellings.

Copper Strip Test

The rapid action of hydrogen sulphide on metals, with the formation of a dark deposit, is the foundation for the commonly used copper strip or copper dish test. Quantitative details of this test for sulphur and hydrogen sulphide are reported by C. E. Waters.[5]

"Although the copper test cannot be relied upon to show the presence of all sulphur compounds in oils, it is a delicate means of detecting free sulphur and hydrogen sulphide. A series of solutions was made by dissolving recrystallized sulphur in a white, medicinal oil which did not darken copper and which was found to contain too little sulphur to detect by analysis. The strongest solution contained 0.100 per cent of free sulphur. By suitable dilution, samples containing down to 0.0001 per cent, or 1 : 1,000,000, of sulphur were prepared. On each piece of freshly sandpapered, washed and dried piece of copper was placed two or three drops of oil. A blank test was run to check the original oil as well as the air of the laboratory. With 0.10 to 0.050 per cent of sulphur the copper was blackened in a few minutes, with 0.033 to 0.017 per cent the copper was perceptibly darker in 30 minutes, and with 0.01 per cent inside of an hour. When left in contact with copper for 20 hours, oil containing as little as 0.0002 per cent of sulphur, or 2 : 1,000,000, caused a just perceptible darkening of the metal. At the final dilution no action could be detected.

Similar tests were made with oil into which hydrogen sulphide had been passed for a few minutes. This solution, which instantly darkened copper, contained 0.037 per cent of sulphur, equivalent to 0.039 per cent of hydrogen sulphide. A portion of this was diluted to 100 volumes and then three or four times to 10 volumes each. The results of the tests with hydrogen sulphide are given in Table 4.

It is evident that the copper test is much less delicate than the sense of smell.

Analysis

All of the standard reference books on gas analysis contain descriptions of methods for the quantitative determination of hydrogen sulphide, but many of these are complicated and require the use of expensive apparatus. A simple method which does not require much apparatus of a complicated sort is described by H. C. Fowler.[6] The gas is collected in a dry bottle and by means of suitable connections and attachments direct titration is made with iodine in the presence of starch. The procedure follows:[7]

Solutions—One-tenth normal solution of iodine made up as follows: 12.692 grams of pure iodine are dissolved in 300 cc. of distilled water in which 18 grams of pure potassium iodide have been dissolved. Add distilled water to make the volume up to 1 liter.

Starch solution for indicator: Rub 2 grams of starch into a paste with a little water, add to 200 cc. of boiling water with stirring. Pour into 200 cc. of cold water. Allow to stand and settle, decant and use clear liquid. Add to a few drops of chloroform or saturate the solution with pure sodium chloride for preserving. It may be necessary to make up this solution from time to time as it will not keep indefinitely.

Apparatus—One clear glass bottle of about 1 liter capacity, with the volume determined accurately by filling with water and measuring, fitted with a rubber stopper. One small calibrated burette, approximately 10 cc., sealed on to one arm of a two-way parallel bore stop cock. The single arm of the stop cock is inserted through a one-hole rubber stopper of a size that will fit the bottle. In the open position, liquid from the burette passes through one of the bores into the bottle. If the stop cock is turned 180 degrees, a small quantity of gas is permitted to escape from the bottle into the air through the other bore. Six feet of three-eighths-inch rubber tubing; one rubber aspirator bulb with double-acting valves of hard rubber.

Determination—In a dry bottle collect a sample of gas through rubber tubing by displacement of air; use rubber bulb to fill bottle if necessary. Whereas there is no noticeable pressure, as from a flowing well or gas line, one end of the rubber hose is inserted into the bottle until it reaches the bottom, and the other end is held directly in the stream line flow. Five or more minutes are usually enough to purge the bottle of air. In sampling from tanks and other places where there is no noticeable pressure, the aspirator bulb, with a sufficiently long suction hose, must be attached to the hose discharging into the bottle. About 200 compressions of the bulb are required to replace the air in a 1-liter bottle. Care must be taken in collecting samples that the person doing the work is not overcome or affected by the gas. Stopper quickly. Add about 25 cc. of distilled water, which contains about 5 cc. of the starch solution, avoiding loss of gas as much as possible, and quickly close with stopper attached to burette. Shake vigorously to facilitate solution of H_2S in the water. Fill the burette with the iodine solution and note the level of the iodine in the burette, let a drop or two of the iodine solution drop in the bottle containing the gas, and shake. If the blue color that first appears in the starch solution fades out, add more iodine, a drop at a time, and shake. Continue this until the blue color no longer fades out, on shaking vigorously. Record the quantity of iodine solution used.

Calculations—1 cc. 1/10 N. iodine = .0017038 gram of H_2S or 1.118 cc. of H_2S at 32° F. and 760 mm.

For temperatures above 32° F. the volume of H_2S will be slightly greater. For 77° F. the volume is as follows:

1 cc. 1/10 N. iodine = 1.22 cc. H_2S at 77° F.

Therefore, the "factor" for 77° F. = 1.22.

Assume the capacity of the bottle to be 1,000 cc.; then the volume of the gas used would be 1,000 cc. Actually the volume of gas is equal to the capacity of bottle minus the volume of liquid used. Suppose 5 cc. of 1/10 N. iodine were used in the titration. The temperature at the time of the determination was 77° F.

The formula is as follows:

cc. of iodine × Factor × 100 = per cent H_2S by volume.

Determination from data above:

$$\frac{5 \times 1.22 \times 100}{1{,}000} = 0.61 \text{ per cent } H_2S.$$

Note—If the gas contains a high percentage of H_2S, it may be necessary either to fill the burette more than once with the iodine solution for one determination or to use a smaller volume of gas. For low concentrations of H_2S gas it is ofen preferable to use weaker solutions of iodine.

Poison

Hydrogen sulphide is known to be a very dangerous poison and may prove fatal if the air breathed contains more than a trace. Irritation and inflammation of the eyes, throat and lungs have resulted from breathing as little as 0.005 per cent, while a concentration of 0.06 per cent is considered high and dangerous. The first objectionable symptoms include slight nausea, watering of the eyes, irritation of the throat and increased respiration. Most of the fatal cases have resulted from continued breathing of the air which was contaminated with the hydrogen sulphide, as when working in a tank or in a condenser box and away from a strong current of pure air. Exposure for five minutes may prove fatal.

A very striking property of this kind of poisoning is the rapidity with which the virulent condition advances from irritation through depression and stupor into unconsciousness. This fact suggests that treatment of a person showing signs of hydrogen sulphide poisoning should be prompt as a few minutes' delay may prove fatal. Fresh air is necessary and artificial respiration should be given while waiting for the arrival of a physician.

Hydrogen sulphide poisoning appears to take place in two stages; these have been defined as acute and subacute. The subacute cases result from brief exposure and where the concentration is not high. The acute condition results in asphyxiation when the person has been exposed for some time and usually to a high concentration of the gas.

When the quantity of hydrogen sulphide is low, 0.005 to 0.02 per cent by volume, and the exposure is brief, a smarting of the eyes, headache and nausea may occur; longer exposure usually causes irritation of the eyes and nose, throat and lungs, which often incapacitates the victim and may result in illness and even death. Exposures to high concentration, above 0.05 per cent, asphyxiation almost invariably results followed by death. The bad odor of hydrogen is distinctive and men should not work without protection when the odor is strong.

Much of our knowledge about the toxic properties of hydrogen sulphide is based on the United States Bureau of Mines investigations.[8]

TABLE 4—COPPER TEST FOR HYDROGEN SULPHIDE

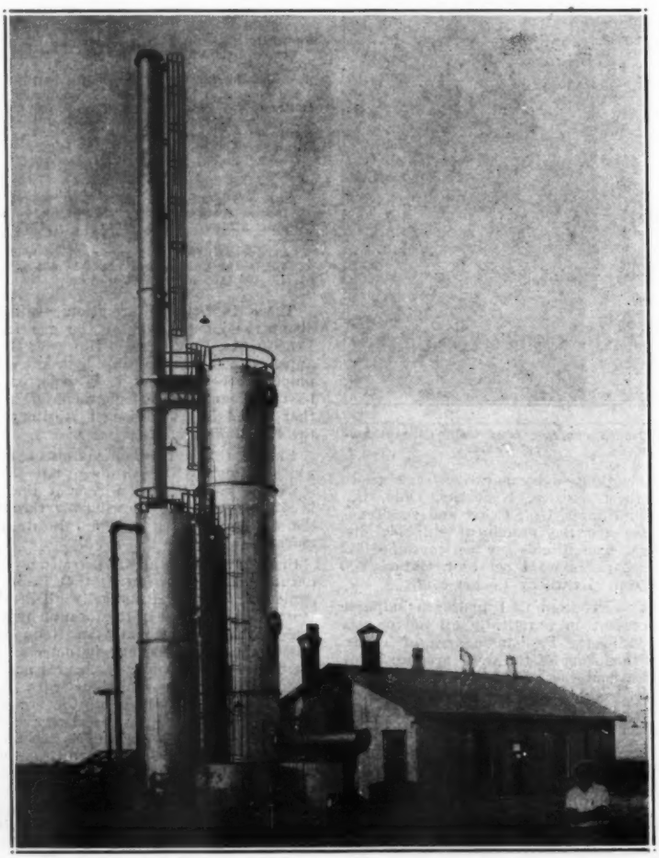
Dilution (volumes)—	Sulphur (per cent)	Parts per million	Odor	Action on copper in 20 hours
100	0.00037	3.7	Strong	Slight
1,000	.000037	.37	Positive	Doubtful
10,000	.0000037	.037	Very faint	None
100,000	.00000037	.0037	None	None

TABLE 5—SUSCEPTIBILITY OF ANIMALS TO HYDROGEN SULPHIDE

Subject—	Pct. for subacute symptoms	Pct. for acute symptoms
Canaries	0.005 to 0.020	0.02 or more
White rats	.005 to .055	.05 or more
Dogs	.005 to .065	.05 or more
Guinea pigs	.005 to .075	.075 or more
Goats	.005 to .090	.090 or more

It is thought that men react in a manner similar to that demonstrated with

(Continued on Page 166)



Plant for removing hydrogen sulphide from natural gas, Gulf Production Co., West Texas.

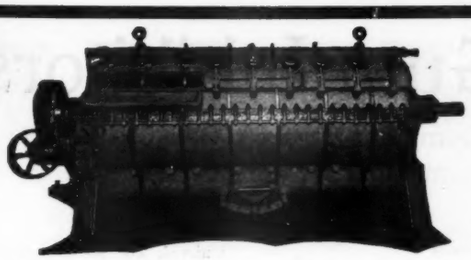
[4] Walter Friedmann, Origin and Refining of Sulphur Oils. The Oil and Gas Journal. December 18, 1930, page 32.

[5] Sulphur in Petroleum Oils. Tech. Paper No. 177, U. S. Bureau of Standards, 1920.

[6] U. S. Bureau of Mines, Cir. 2,847.

[7] For other analytical methods see Tutwiler method, The Gas Chemists' Handbook, page 462, etc. See also Circular 32, Bureau of Standards. The Oil and Gas Journal, June 16, 1927, page 140.

[8] Sayers and others, Bulletin 231, Investigations of Toxic Gases from Mexican and Other High Sulphuric Petroleums and Products, 1925.



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Value of Color and Gum Inhibitors

Large Quantities of Acid Eliminate Gum, but Darken Gasoline Until Equilibrium Reached. Optimum Must Be Observed

By H. W. Sullivan
Phillips Petroleum Corp.

Excessive gums in a gasoline are not desirable and should be removed, but a yellowish or greenish cast in gasoline does not necessarily mean that this particular gasoline is not an excellent motor fuel—general public opinion to the contrary.

It is possible to treat for a gasoline which has a low gum content and good color stability, but, in general, this is a very expensive operation, both from chemical consumption and loss of product, and usually the antiknock qualities will be materially affected. Consequently, most refiners blend their straightrun and cracked products together in such proportion that the gum and color specification can be met, or as an alternative, dye the gasoline to mask the color and be more lenient with gum specifications.

Egloff, Faragher and Morrell[1] have shown that certain chemicals will inhibit the formation of gums, and will act as stabilizers to color on some gasolines. Unfortunately very few gasolines display similar characteristics, so that it is not possible to predict how inhibitors will react when applied on different stocks.

To cite an example: A gasoline of 425° endpoint from Dubbs pressure distillate, which had been treated with 4 pounds per barrel of 66° Baume sulphuric acid, washed and neutralized, was divided into four equal cuts.

Effect of Inhibitors

Tables No. 1 and 2 show the effect of several inhibitors on the various cuts with regard to color and gum. The inhibitor was added in each experiment in the proportions of 1 pound to 8,000 gallons.

Charging Stock

The charging stock to the pressure still was composed of 20 per cent recycle stock and 80 per cent virgin gas oil, and had the following tests:

Gravity	26.5°Be.
Initial	420°F.
10%	502°F.
20%	542°F.
30%	566°F.
40%	596°F.
50%	622°F.

The untreated pressure distillate resulting from this stock tested as follows:

Gravity	51.5
Initial	96°F.
10%	162°F.
20%	209°F.
30%	258°F.
40%	302°F.
50%	351°F.
60%	390°F.
70%	448°F.

There is no reason to believe that a change of a few per cent in the amount of recycle added or removed would not completely reverse the results obtained from the above gasolines.

Aging Test

Considerable interest has been shown concerning the accelerated aging test. The Ethyl Gasoline Corp. specifies a bomb of definite dimensions, 100 c.c.s of sample in a 4-ounce sample bottle, 100 pounds oxygen pressure, and a temperature of 212° F., for four hours. The induction period, or time interval between the starting of the test and the first indication of a drop in pressure, is considered a criterion from which to judge how long a gasoline may stand in storage before excessive gum formation will occur.

The Navy has a similar test, but slightly different procedure, e.g., 100 c.c. of sample in an 8-ounce sample bottle, 100 pounds oxygen pressure, and a temperature of 210° F. for two hours, the oxidized sample evaporated in a porcelain dish, after the procedure of the copper dish gum, and the result calculated as potential gum.

It is hoped that some form of an accelerated aging test may be developed that will give an indication of the gum which will be formed during storage and approximately how much time may elapse before this gum is formed. The present methods may be satisfactory, but the history built up around these methods is not complete enough to permit accurate predictions. It has been more or less arbitrarily stated that a gasoline with an induction period less than 3½ hours, according to the Ethyl Gasoline Corp.'s method, would in all probability, form excessive gum in 9 or 10 months. A sample of gasoline, was examined recently which had been in storage, away from direct light, but not in a dark room, for 10 months. The original gum by the copper dish method, admittedly not reliable, was 20 milligrams, and an induction period of 2¾ hours. The gum content after storage, by the copper dish method, was 28 milligrams; by the porcelain dish method it was nil, while the induction period was 2¼ hours. If the ratio between dissolved gum and induction period before and after storage can be credited, then this particular gasoline could probably be stored for at least 18 months without excessive gum formation. If we assume that 50 milligrams is probably the maximum gum allowable before trouble might be expected.

Acid Treating

The usual method of treating pressure distillate is to contact with sulphuric acid of concentrations varying from 50 per cent H_2SO_4 to 93 per cent H_2SO_4, followed by water and caustic washes. It is generally agreed that the acid acts upon the unsaturated compounds forming first, neutral or di-alkyl esters, then, when more acid is used, acid of mono-alkyl esters are formed. The acid esters are soluble in water and caustic, and are removed. The neutral esters are soluble in the oil and cannot be removed by washing. It is the di-alkyl esters which give so much trouble in the subsequent re-distillation, decomposing and liberating sulphur dioxide which combines with the moisture and soon destroys vapor lines and condensers. This corrosion can be retarded by the use of caustic or ammonia in the vapor lines.

It was first thought that the color of the resultant gasoline might be related to the acid formed in the gasoline during distillation. This is not true, as an examination of Table 3 will show. However, it does appear that the quantity of neutral esters formed is proportional to the concentration of acid, rather than to the quantity of acid used.

Referring to the curves, it will be noted that the color reaches a maximum with 6 pounds of acid, and then drops with additional acid and finally becomes constant with 15 or 20 pounds acid per barrel of oil. By changing the quantity of acid, this curve should be representative of most pressure distillates.

TABLE NO. 1—EFFECT OF INHIBITORS

Gasoline* No.	Original color	No inhibitor hours 1	2	3	Anthracene hours 1	2	3	Gum camphor hours 1	2	3	DuPont No. 2 hours 1	2	3	Aniline hours 1	2	3
1	20	17	16	16	17	16	16	17	16	16	16	16	16	17	16	14
2	27	26	26	26	27	27	27	27	27	27	27	27	27	27	26	26
3	22	22	22	22	23	22	21	23	22	22	22	22	22	23	20	17
4	16	16	15	15	16	16	15	16	16	14	16	16	16	15	14	12
5	15	15	15	15	16	16	16	15	15	15	15	16	16		Dark	
6	19	18	18	18	19	18	17	19	19	18	19	19	17	17	15	13
7	27	26	22	20	26	24	23	26	24	20	25	24	24		Dark	

*With the exception of Samples Nos. 1 and 7, it will be noted that there was little or no color drop after three hours' exposure to the sun without the use of any inhibitor. Sample No. 6 is especially significant in that it lost only one point in color. This would indicate that Samples Nos. 2 and 3, which are relatively poor in color compounds, have diluted Samples Nos. 4 and 5 to the extent that Sample No. 6—the composite—will hold to a constant color. Sample No. 7 lost seven points in three hours, indicating that regardless of the initial color, the gasoline will approach the color of the darkest cut contained in that particular gasoline. Some chemicals inhibit the formation of color, as shown by the anthracene and DuPont No. 2. Others accelerate the color formation as shown by the aniline.

TABLE NO. 2

Gasoline* No.	Dissolved gum—Mgs./100 c.c. Evaporation made in Seliminite dish: No inhibitor	Gum camphor	Anthracene	DuPont No. 2	Induction period (hours) Accelerated aging test: No inhibitor	Gum camphor	Anthracene	DuPont No. 2
1	92.0	29.6	18.6	45.2	1	4¼	3	3¼
2	3.8	16.2	0	.2	1¼	¾	1	1
3	1.4	15.8	.8	1.4	1	¼	¾	⅓
4	7.8	14.4	4.6	2.6	3¾	1¼	4	3
5	6.2	13.6	7.8	2.6	3¾	4	4	4
6	5.4	0	5.0	0	1	3½	3½	4

*1—Untreated gasoline from untreated pressure distillate. Nos. 2, 3, 4, and 5—equal cuts of a 425 endpoint doctor sweetened gasoline from Dubbs pressure distillate treated with 4 pounds of 66° Baume sulphuric acid, washed and neutralized. Distillation made using fire and steam. Inhibitor added 1 pound per 8,000 gallons gasoline. No. 6—Composite from Nos. 2, 3, 4, and 5. No. 7—Sample No. 6 treated with 1 pound per barrel 66° Baume sulphuric acid and 3 pounds per barrel clay.

TABLE NO. 3—ACID CONTROLS STABILITY

Treat No.	Acid lbs./bbl.*	Reaction	Color	Gum†
1	0	Neutral	15	274
2	1	Neutral	16	268
3	2	Acid @ 350°F.	17	243
4	3	Acid @ 346°F.	21	196
5	3	Acid @ 245°F.	17	151
6	5	Acid @ 285°F.	23	143
7	6	Acid @ 280°F.	26	92
8	9	Acid @ 280°F.	22	46
9	10	Acid @ 274°F.	21	22
10	15	Acid @ 273°F.	20	12
11	20	Acid @ 240°F.	20	3
12	40	Acid @ 235°F.	20	none

*Treat No. 5 used 98 per cent H_2SO_4, all others 93 per cent. †Gum (potential mgs./100 c.c. by Ethyl Gasoline Corp. method).

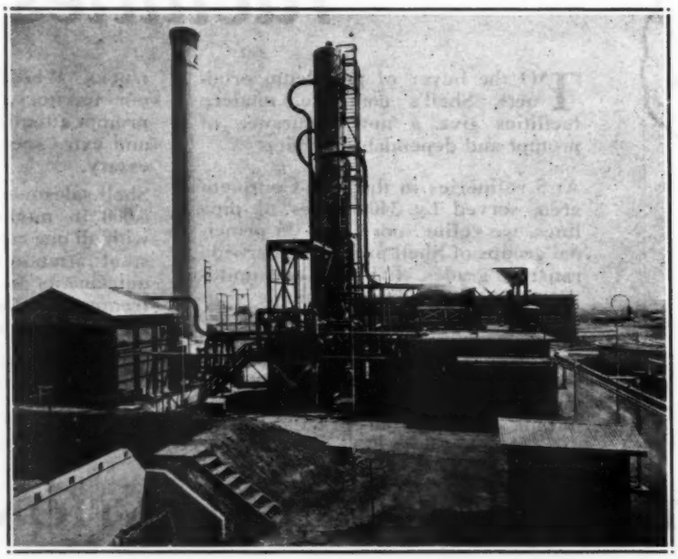
The above treats were thoroughly water washed and neutralized with 8° Be. caustic after acid treating.

A partial explanation of the color-acid curve would be that in the front end of the curve—up to 6 pounds—such unsaturated compounds which have a yellow color and boil within the gasoline range, have not been precipitated, while at exactly 6 pounds the removal of unsaturates and the formation of colored sulphur compounds which boil in the gasoline range are in equilibrium, and a practically white gasoline is obtained. Then when more acid is added—above 6 pounds—the formation of sulphur compounds resulting from the acid treatment is greater, giving the gasoline an increasingly darker color until equilibrium is reached again. The formation of acid, as found in the residue appears to decrease as the quantity of acid used in treating increases. Large quantities of acid eliminate gum.

Conclusions

1. Certain chemicals will inhibit appearance of color in some gasolines.
2. The quantity of gum contained in a gasoline is in proportion to the quantity of acid used on the pressure distillate.
3. There is an optimum amount of acid to use, above which greater or lesser amounts of acid will give a dark colored gasoline—time and temperature being constant.
4. The gums which will be formed while a gasoline is in storage cannot be accurately predicted.

[1]Group meeting, American Petroleum Institute, Chicago, December 5, 1929.



Crude oil topping unit (Badger type) at Watson, Calif., refinery of the Associated Oil Co.

EAST TEXAS MAPPED FROM AIR

An area extending from the northern boundary of Nacogdoches County to Titus County, comprising over 1,000 square miles of East Texas oil territory has been mapped by the Fairchild Aerial Surveys, Inc., Dallas, Tex., according to Stuart Moir, manager, to supply the oil man, the geologist and the land man with accurate maps of this region.

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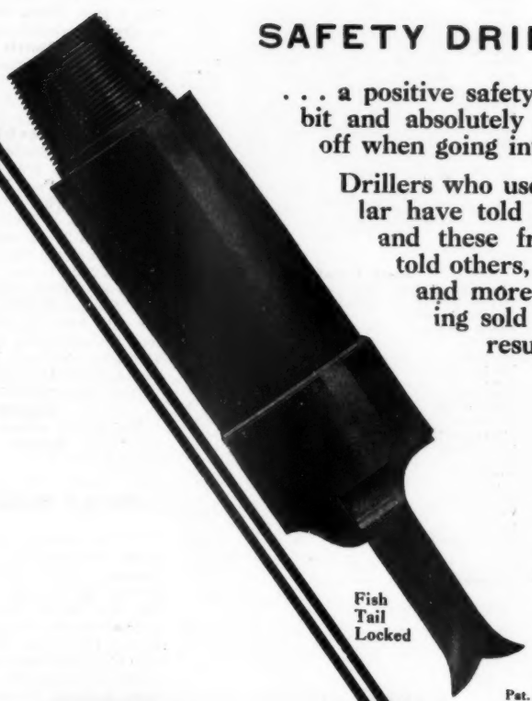
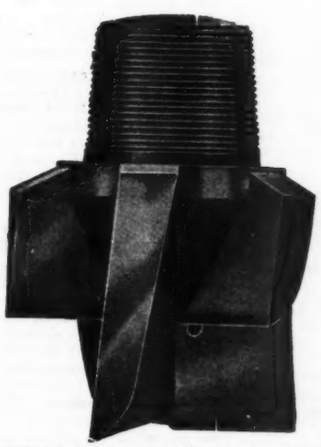


Pat. Pending No. 487,553



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GULF COAST FIELDS

(Continued from Page 58)

fact that 2,008 feet of salt had been penetrated put a stop to further drilling.

Jefferson Lake Oil Co.'s No. 10 Lake Peigneur, Section 58-12s-5e, Iberia Parish, Louisiana, located on the Jefferson Island Dome, bailed a little oil from a sand at 1,849 feet and may be put on the pump. So far there has been no production on this dome, a member of the group of domes known as the Five Islands. These are among the oldest known domes on the coast and some of them being very shallow have been mined for salt for years, but none has been productive of oil. The importance of the showing at Jefferson Island is indefinite at this time. The oil, however, is a good dark green Grade A oil with gravity of 21.4°.

Victoria County

There were no new developments at Leesville, LaFourche Parish, Louisiana, or in the Bloomington-Mariana district of southwestern Victoria County, Texas, where two new coastal producing areas were opened during the previous week. At Leesville, The Texas Company's No. 2 Louisiana Land, discovery well which came in estimated as good for between 400 and 500 bbls. from sand at a total depth of 3,028 feet, late the past week was flowing 200 bbls. daily on a half-inch choke with pressure of 330 pounds. The oil is being run to small storage, from where it will be barged out. The well is located in the marsh lands along the Gulf and is accessible to water transportation.

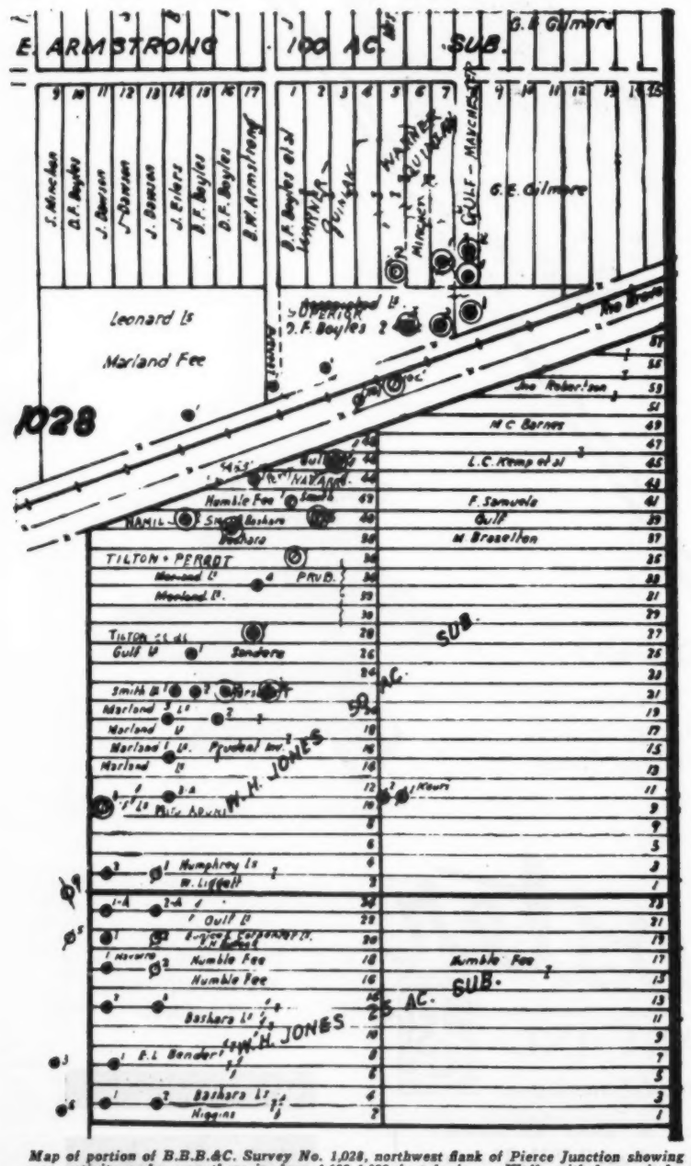
The Texas Company's No. 2 McFaddin, C. M. B. Hoyd Survey, Victoria County, which blew in two weeks ago as a 30,000,000-foot gas well from a sand around 2,000 feet, has been shut in. Total depth of the hole is 2,025 feet. This well is believed to have opened a new gas field near Bloomington and Mariana. It is approximately 3½ miles to the west of the field recently opened by Lion Oil & Refining Co., in the M. Traviesa Survey, in which two gas wells have been completed. No new locations have been made in either district but United Production Corp., which has taken over the gas rights of the Lion block, is rigging up for No. 1-B McFaddin, location for which was reported the previous week.

Pure Oil Co. is due for another good well at its Sweet Lake Field in Cameron Parish, Louisiana, where its No. 10 Yount Lee Oil Co. is in sand showing oil at 6,805-30 feet with 8⅝-inch casing cemented at 6,796 feet. This well is in the same sand and the same immediate area as No. 9 Yount Lee, which has been flowing steadily around 1,150 bbls. of oil daily ever since completion early last autumn. Although all Sweet Lake wells have been deep, the discovery well being at 5,897 feet, Nos. 9 and 10 are the deepest of the field.

Daily average production of coastal fields for the week ended February 28 was:

GULF COAST PRODUCTION

Texas	
Allen	64
Barbers Hill	21,337
Batson	1,014
Big Creek	2,821
Blue Ridge	1,265
Brenham	141
Boling	705
Clay Creek	1,727
Damon Mound	595
DeWalt	11,980
Esperson	2,318
Fannett	612
Goose Creek	4,215
Hankamer	2,499
High Island	400
Hull	6,391
Humble	9,595
Lost Lake	326
Markham	195
Moss Bluff	387
Mykawa	158
Nash	225
North Dayton	902
Orange	1,612
Orchard	2,045
Pierce Junction	9,016
Port Neches	1,513
Raccoon Bend	9,197
Refugio	33,574
Rockland	4
Saratoga	1,007
Sour Lake	2,090
South Liberty	2,948
Spindletop	12,883
West Columbia	4,538
Total Texas Coast	150,199
Week ended February 21	151,034
Decrease	835
South Louisiana	
Anse La Butte	55
Bayou Blue	145
Bayou Bouillon	157
Black Bayou	975
Edgerly	738
Jennings	721
Hackberry	3,363
Iowa	Shut in
Lake Barre	3,084
Lake Pelto	119
Leesville	225
Lockport	5,085
Port Barre	1,696
Sorrento	50
Starks	766
Sulphur	1,986
Sweet Lake	1,139
Vinton	6,589
Welsh	77
White Castle	945
Total Louisiana Coast	27,915
Week Ended February 21	26,414
Increase	1,501
Total Gulf Coast	178,114
Week ended February 21	177,448
Increase	666



Map of portion of B.B.B.&C. Survey No. 1,028, northwest flank of Pierce Junction showing new activity under way there in deep 4,100-4,300 foot horizon. Wells with large circles indicate either old wells deepened or drilling deeper, or new wells completed or drilling.

KANSAS FIELDS

(Continued from Page 51)

NW, Section 21-33-3, has been completed for 15 bbls. in sand 3,270-75 feet.

Butler County

E. W. Marland, Inc.'s No. 2 Anderson, NW cor. SW NE, Section 6-27-4, has been completed for 225 bbls. in sand 2,920-21½ feet.

Ellis County

Deep Rock Oil & Refining Co.'s No. 1 Perry, NE cor. SE, Section 19-11-17w, has been abandoned at 3,495 feet.

Greenwood County

Simmons and others' No. 4 Wineger, NW cor. SW, Section 27-23-11, is a rig. No. 2 Inthurm, SW cor. SE SE, Section 19-22-12, is dry and abandoned at 1,965 feet.

Marion County

Youker and others' No. 2 Riffel, SW cor., Section 11-17-4, has been completed for 70 bbls. in sand 2,312-77 feet.

McPherson County

Moriarty and others made location for No. 2 Sadie, C SE SW, Section 2-19-2w, Ritz-Canton area. McPherson Oil & Gas Developmet Co. and Shell Petroleum Corp. made location for No. 1 Decker "B," C NE, Section 11-19-2w. Dickey Oil Co. and Shell Petroleum Corp. staked location for No. 1 Decker, SE cor., Section 35-19-2w. Lario Oil Co. and Shell Petroleum Corp. made location for No. 1 P. J. Becker, SW cor. SE NE, Section 36-19-2w. The Texas Company made location for No. 1 Flook, SW cor., Section 29-19-1w. McPherson Oil & Gas Development Co.'s No. 1 Meyers "B," C SE, Section 14-19-2w, has been completed for 30,000,000 feet of gas in chat 2,899-2,930 feet. Carey and Shell Petroleum Corp.'s No. 1 Smith, C NE SW, Section 15-19-2w, made 212½ bbls. in chat 2,928-72 feet. Barnsdall Oil Co. and The Texas Company's No. 1 Aelmore, C NE NE, Section 22-19-2w, has been completed for 207 bbls. in 20 hours from chat 2,934-98 feet. McPherson Oil & Gas Development Co.'s No. 1 Finkle, C NE NW, Section 23-19-2w, was completed for 14,300,000 feet of gas in chat 2,925-61 feet. C. B. Davis and Shell Petroleum Corp.'s No. 1 Ritz, SE cor. SW, Section 19-19-1w, flowed 660 bbls. in 9½ hours from Viola lime 3,425-39½ feet. Madison and Shell Petroleum Corp.'s No. 1 Unruh, NW cor. SE, Section 31-19-1w, has been completed for 8,750,000 feet of gas in chat 2,926-48 feet. Lario Oil Co. and Shell Petroleum Corp.'s No. 4 Miller, NW cor. SE, Section 1-20-2w, has been completed for a potential of 2,796 bbls. in chat 2,977-80 feet. Otstot and others' No. 2 Munn, SW cor., Section 6-20-1w, made a potential of 1,100 bbls. in chat 2,924-73 feet. Tidal Oil Co., Slick, Pryor & Lockhart's No. 1 Peel, C SW SW, Section 35-17-3w, is dry and abandoned at 3,646 feet.

Morris County

Urschell and others' No. 1 Scott, NE cor. SW, Section 6-16-6, an old well drilled deeper, is dry and abandoned at 2,875 feet.

Sedgwick County

Magnolia Petroleum Co.'s No. 2 Vickers, NW cor. SW SW, Section 17-27-2, Eastborough Pool, has been completed for 350 bbls. in chat 2,941-55 feet. Fisher & Lauck's No. 2 Trustee, SW cor. SE, Section 19-27-2, an old well deepened, has been completed for 300 bbls. in Wilcox sand 3,242-51 feet. Vickers Petroleum Co. and others' No. 2 Keys, NW cor. NE, Section 30-27-2, has been completed for 300 bbls. in Wilcox sand 3,248-54 feet. Blankenship Petroleum Corp.'s No. 1 Shaffer, NE cor. NW, Section 30-27-2, swabbed 440 bbls. the first 16 hours from Wilcox sand 3,247-57 feet.

Sumner County

Fisher and others moved a machine in for No. 1 Warner, C NW SE, Section 23-34-2.

ROCKY MOUNTAIN AREA

(Continued from Page 59)

mons, C S half NE, Section 7-4s-66, near Aurora, which last week was reported having 400 feet of fluid, of which 150 feet was water, standing in the hole at a total depth of 5,735 feet, reported no change this week. Plans to drill the well into the sand were held in abeyance due to W. H. Ingersoll, the driller, suffering from a badly burned leg. He is under the care of a physician. A test of the oil taken from the well a week ago showed a gravity of 34.4° corrected to 60° F.

Morgan County

Indian Territory Illuminating Oil Co.'s No. 1 State, C NE NE, Section 16-1n-57, Fort Morgan district, is reported bottomed at 4,090 feet and is underreaming. Considerable trouble with the 6⅝-inch has delayed drilling. The string was pulled and all but two joints have been rerun.

Adams County

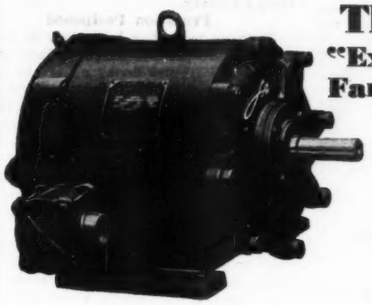
Nettie M. Slatt's No. 1 Hills, SE cor., Section 27-3s-64, has resumed at a total depth of 2,508 feet. It was drilled to 2,500 feet, at which depth the 10½-inch was landed. The string was not cemented, but a formation shutoff was obtained. The hole then was deepened 8 feet and began to show considerable gas. It was decided to suspend until the 8⅝-inch casing was on the ground. The drillers put 300 feet of mud in the hole to hold down the gas while operations were suspended and this is being cleaned out. Four thousand feet of 8⅝-inch seamless casing is now on the racks.

Jefferson County

Ruby Hill Oil & Gas Co.'s No. 1 Braden, SE cor., Section 24-4s-69, near Denver, has made no new hole since reaching a depth of 3,864 feet several weeks ago. About 40 feet above this depth it had a good show of gas with some rainbows on the water. Since this gas was encountered in a sandy shale the hole has been caving badly and cleaning out is in progress.

Larimer County

Continental Oil Co.'s No. 3 Scott, SW SE, Section 6-9n-68, Wellington Dome, is shut down at 4,932 feet. This well was a producer in the Muddy sand and was deepened to test the lower horizons. It found water in the Dakota and Lakota. The last named sand was cased off with



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the 4¾-inch which was cemented at 4,645 feet. More water was found below that string and the hole is supposed to be bottomed in the top of the Sundance, or the equivalent of that formation. It is doubtful if an attempt will be made to drill it deeper as the tools are lost at the bottom. So far the Muddy, or first Dakota, is the only horizon on the Wellington Dome which has been found productive.

Standard Oil Co. of Colorado's No. 1 Hertha, NW cor., Section 21-4n-69, Berthoud Dome, is drilling at 3,780 feet in a very hard sand which is saturated, but which yielded no increase in production. The top was found at 3,750 feet and was very hard. At 3,763-65 feet, the formation softened and this was where the oil came in. It is making 125 to 150 bbls. daily by swabbing. This company has made a contract with Ike Mosher for the drilling of its No. 1 Wilson, a new location, in the NW cor. SW, Section 21-4-69, half a mile south of No. 1 Hertha. Its No. 2 State, C NW, Section 16-4n-69, is moving in rig, and its No. 1 Hall, NE cor., Section 20-4-69, is rigging up.

WYOMING

Natrona County

The test well drilled on the Midway Dome south of Salt Creek by the Midwest Refining Co. in its No. 11 Middy, C NE NE, Section 23-35-79, for its joint account with the Salt Creek Producers Association, Mountain Producers Corp., and Midway-Geary Syndicate, is to be deepened to test lower horizons. This well was temporarily completed in the second bench of the second Wall Creek sand at a total depth of 5,215 feet last fall. It made some water with the oil and was plugged back to 5,207 feet and pumped for several months. Production dropped to around 60 bbls. a day and two weeks ago this was stimulated temporarily by two small shots. However, the production dropped back to where it was before the hole was shot. Following the drilling in of this well, a test was drilled on the Geary Dome in the Midwest's No. 11, SE NW NW, Section 32-34-77. It penetrated the second Wall Creek without finding production and is standing with the 9⅝-inch cemented on bottom at 5,340 feet. It will remain standing while the crew is engaged in drilling the Midway test deeper. This well probably will be carried through the Dakota series unless production is found above that horizon.

Fremont County

Producers & Refiners Corp.'s No. 10, NW cor. SW, Section 14-32-95, Big Sand Draw, which has penetrated all horizons down to the bottom of the Morrison, was cored to 4,604 feet and has been reamed to 4,579 feet. The plans are to test the Sundance and possibly lower horizons. A. B. Palmer, of the Sperry-Sun Well Surveying Co., has been making a survey of the Big Sand Draw test to determine its divergence from the vertical. This is believed to be the first well thus surveyed in the Rocky Mountain area. Texas Production Co.'s No. 1 State, SW SW, Section 36-34-95, Alkali Butte, is underreaming at 4,470 feet and the 6⅝-inch is at 4,425 feet. Total depth is 4,485 feet.

Park County

Midwest Refining Co.'s No. 31 Rosenberg, SW SE, Section 24-58-98, Frannie Dome, is shut down at 4,230 feet. It has been in the red beds for more than 1,200 feet and as the formation is tilted almost vertical at this location, there is not much prospect of getting through it.

Niobrara County

Argo Oil Co.'s No. 1 Elliott, NW cor., Section 5-35-65, Lance Creek, a producer being deepened to the Lakota, is drilling at 3,065 feet in sand. It topped the first Dakota at 3,048 feet and encountered a flow of several million feet of gas. It will be drilled through the second Dakota before stopping to test and before entering the Lakota.

MONTANA

Two completions were reported in Montana, both of which were small wells. Nepstad-Vander-Pas' No. 5 Levnick, NW SW, Section 27-35-1w, in the Kevin-Sunburst Field, was completed in a stray sand at a total depth of 1,406 feet with an initial production of 12 bbls., and Jones, Rice & Perkins' No. 1 Roebuck, NW cor. SE, Section 28-33n-12e, on the Kremlin structure in Hill County, was completed in the Eagle sand at 610-75 feet as a gas well with an initial production of 1,500,000 feet. Total depth was 745 feet. Same interests are drilling at 300 feet in their No. 1 Dull, NE cor., Section 4-32-12.

Toole County

Ashalta Oil Co.'s No. 1 Volbrecht, NE cor. SE, Section 11-37-4w, Border Field, is drilling at 2,450 feet. A-1 Petroleum Co.'s No. 1 Barthelote, SW SE NE, Section 24-36-1e, Barthelote district, is drilling at 1,000 feet, and the Liquid Gold Oil Co.'s No. 1 Roberts, C NW NE, Section 25-36-1e, is drilling below 1,900 feet.

Liberty County

Utopia Oil Co.'s No. 1 Eleanor, SE SE, Section 11-33n-6e, Utopia district, east of the Seetgrass Arch, which has been shut down at 3,150 feet, resumed the past week and at 3,214 feet, is reported to have touched a sand and an air pocket which blew the tools up the hole where they lodged. More than 150 feet of sand was reported bailed from above the stuck tools and cleaning out around the tools in an effort to get a hold on them is in progress.

Glacier County

B. & H. Oil Co.'s No. 1 Haines, C SE SE, Section 2-34-6w, Cut Bank district, is working with bad pipe at a total depth of 2,762 feet. At this depth it had a show of oil. Jeffries-Harre's No. 1 Dawson, SE cor. NE, Section 17-31-12w, is drilling below 3,060 feet. Fulton Petroleum Co.'s No. 1 Blackfoot, SW NE NE, Section 28-36-12w, Milk River, is straightening crooked hole at 1,185-1,200 feet.

Cascade County

Lone Star Montana Oil Co.'s No. 1 McLean, SE NW SW, Section 13-21-3e, Blackhorse Lake, which has been inactive at a total depth of 800 feet for several years, where it lost the hole, is building rig to start a new hole at same location.

Fergus County

Northern States Oil Co.'s No. 1 Woodward, SE cor. SW, Section 20-14n-24, Button Butte, is drilling at 2,100 feet, and the Melton Corp.'s No. 1 Fenholt, SW cor., Section 24-21-17, is resuming at 2,800 feet. This well has been drilling intermittently for the past three years.

Golden Valley County

Texas Pacific Coal & Oil Co.'s No. 1 Northern Pacific, SW cor., Section 21-8n-21, Woman's Pocket, is shut down at 2,660 feet for boiler repairs after successfully cementing off big flow of water. The stream of water is reported to have broken out of a nearby hillside.

Rosebud County

Prairie Oil & Gas Co.'s No. 1-X, Contract 3, SW NW, Section 26-10n-39, Porcupine Dome, is bottomed at 2,325 feet and is drilling up underreamer lug, and its No. 1, Contract 4, SW SW, Section 28-11-39, is shut down at 1,360 feet.

Rocky Mountain Production

Average daily runs from fields week ending February 28:

WYOMING	
Salt Creek	26,990
Big Muddy	1,930
Byron	10
Cody	10
Dallas-Derby	270
Dutton Creek	130
Elk Basin	650
Ferris	10
Frannie	930
Grass Creek	2,180
Greybull	10
Hudson	350
LaBarge	1,540
Lance Creek	190
Lost Soldier	3,920
Lovell	10
Oregon Basin	1,920
Osage	1,600
Rock River	2,030
Poison Spider	270
South Casper	200
Teapot	20
Warm Springs	
Total Wyoming	45,170
MONTANA	
Buckley-Border	680
Cat Creek	1,090
Dry Creek	660
Kevin-Sunburst	4,500
Lake Basin	70
Pondera	1,750
Total Montana	8,750
COLORADO	
Florence	510
Fort Collins	1,050
Iles	990
Orchard	400
Moffat	1,030
Rangely	50
Tow Creek	370
Total Colorado	4,490
NEW MEXICO	
Rattlesnake	950
Hogback	480
Table Mesa	81
Artesia	954
Cap Rock	422
Getty	68
Hobbs	31,664
Jal	1,079
Lea	2,176
Eunice	2,343
Texas-Pacific area	76
Total New Mexico	40,293
Total Rocky Mountain area	98,613
Total previous week	100,148
Difference	1,535

EAST CENTRAL TEXAS

(Continued from Page 69)

summated although it has been reported numerous times.

Gregg County Test

Another interesting test of Gregg County is H. W. Evans (Lloyd Oil Corp.) No. 1 Andrews in the William F. Hyde Survey, 2 miles northwest of Kilgore. It topped the Pecan Gap at 2,565 feet with an elevation of 382 feet. This makes the well about 20 feet higher than the Bateman discovery 5 miles south. A late report gives it drilling at 2,775 feet. This test is on a bee-line between the Bateman discovery and Farrell-Lathrop discovery wells.

Due to the fact that operators have perhaps not been as careful in drilling their wells in the Joiner Field as they should have been, it is generally believed many of the wells have crooked holes, especially those which have seemingly reached beyond the depth at which the sand should have been encountered, but has not been found, and this was proved during the week when the Universal Oil Co. made an acid test of its No. 1 Brown and found that the greatest deviation was 20 degrees from perpendicular in one place. This well was bottomed at 3,726 feet in the belief it was a dry hole, but as it is only one offset location north of the Haynes Drilling Co.'s No. 1 Brown in the Prue Survey, and that well made a good well, and a western extension to the field, the Universal Oil Co. officials thought something was wrong with their test, and upon checking it up found just what the trouble was. It will be plugged back to around 2,000 feet and redrilled.

The Sinclair-Texas Pipe Line Co. shipped out its initial shipment from its own loading rack at Friar Switch, north of Joiner Field, on February 28, the first consignment consisting of 30 cars. Oil from the field was run through the company's new 6-inch welded line, which was completed last week.

Shipments from the three pools average around 40,000 bbls. per day, 25,000 going out of Friar Switch, north of the Joiner Field, 10,000 going out of the Bateman area and 5,000 going out of Gregg County.

Proration Postponed

Nothing more has been done in regard to trying to prorate the new East Texas areas, and it now looks as if the fields were getting farther from proration than ever with more lines going into the fields, and planned, and more refineries being built and contemplated at various locations. No one or few major pipe line companies will be able to force proration in this district as in other producing districts in Texas, and something else will have to enter the picture to curtail drilling activities and cut down the allowable production of the wells. The railroads will not try to help prorate for they can use the profits which they will derive from hauling the oil, and the small pipe line companies certainly do not want to force the issue.

The first unit development plans for the newly discovered areas of East Texas were announced this week by the Gulf Production Co. and Devonian Oil Co. on its Overton block, and R. R. Penn and B. B. Smith on their Upshur County block. The former two companies have 1,200 acres in their block, and are ready to spud in on their first test, which will be located in the northeast corner of the Ida V. Buford's 147-acre farm in the William Killen Survey, 1½ miles northeast of Overton. The Magnolia Petroleum Co., Humble Oil & Refining Co., Shell Petroleum Corp. and others are interested in this block also.

Penn & Smith have a 4,000-acre joint block 3½ miles north of Gladewater in Upshur County, and a location has been staked on the Ollie B. Gage's 103-acre farm in the J. B. Davenport Survey for a unitized test.

The Van Field was the first field in East Texas to be drilled under such arrangements, the Pure Oil Co., discoverer of the pool, doing the development for the five interested companies in that field.

COMPLETIONS IN EAST CENTRAL TEXAS

Cherokee County

Barry & Hale's No. 1 Mrs. M. Jones, dry and abandoned, total depth 3,998 feet.

Fannin County

J. A. Beck's No. 1 E. Morgan, dry and abandoned, total depth 3,501 feet.

Limestone County

A. M. Yost's No. 1 Fenner, dry and abandoned, total depth 3,881 feet.

Panola County

Natural Gas Production Co.'s No. 1 H. B. Alford, initial production 36,192,000 feet of gas, total depth 4,710 feet.

Polk County

Sunshine Oil Co.'s No. 1 J. P. Collins, dry and abandoned, total depth 3,341 feet.

WILDCAT OPERATIONS IN TEXAS PANHANDLE

(Continued from Page 70)

Beck's No. 1 Sullivan, 330 ft. N and E, W½ NW, Sec. 135, Blk. 3, I.&G.N. Sur. — Drlg. 3,020 ft.

Boyles et al's No. 1 Colebank-Morse, 330 ft. NE, Sec. 65, Blk. 25, H.&G.N. Sur. — Spudded and S.D.

Brown et al's No. 1 Duncan, 330 ft. S and E, NW, Sec. 93, Blk. 3, I.&G.N. Sur. — S.D. 740 ft.

Danciger O. & R. Co.'s No. 1 Sullivan, 231 ft. N, 224 ft. W, of E 160 ac. of S 264 ac., N½, Sec. 136, Blk. 3, H.&G.N. Sur. — Standardizing 2,850 ft.

Danciger O. & R. Co.'s No. 1 Barnett, 231 ft. S, 330 ft. W, E½ of N 56 ac., Sec. 136, Blk. 3, I.&G.N. Sur. — S.D. 2,996 ft; S.G; to drill in.

Danciger O. & R. Co.'s No. 2 Sullivan, 231 ft. N, 884 ft. W of E 160 ac. of S 264 ac., N½, Sec. 136, Blk. 3, H.&G.N. Sur. — Estimated 6,000,000 ft. gas 2,997-3,065 ft; S.O. 3,155-69 ft; T.D 3,351 ft; swbng. 30 bbls. a day from lime pay 3,155-69 ft.

Empire G. & F. Co.'s No. 3 Wall, 990 ft. S and W, NW, Sec. 161, Blk. 3, I.&G.N. Sur. — Drlg. 1,895 ft.

Hurst et al's No. 1 Ayres, 330 ft. S and E, Sec. 76, Blk. 3, I.&G.N. Sur. — Rotary rig.

Jean Pet. Co.'s No. 1 Furneaux Bros., 330 ft. N and W, cor. SE, Sec. 200, Blk. B-2, H.&G.N. Sur. — S.D. 2,770 ft.

Kewanee O. & G. Co.'s No. 1-D Morse, 330 ft. N and W, S½ SW, Sec. 16, Blk. A-9, H.&G.N. Sur. — Drlg. 1,605 ft.

Kewanee O. & G. Co.'s No. 1 Morse, 330 ft. N and E, S½ SE, Sec. 15, Blk. 9-A, H.&G.N. Sur. — Drlg. 925 ft.

Kewanee O. & G. Co.'s No. 3 Smith, 330 ft. N and W, Sec. 149, Blk. 3, I.&G.N. Sur. — Drlg. 2,625 ft.

Magnolia Pet. Co.'s No. 1 Barrett, 330 ft. S and E, NE, Sec. 112, Blk. 3, I.&G.N. Sur. — Drlg. 330 ft.

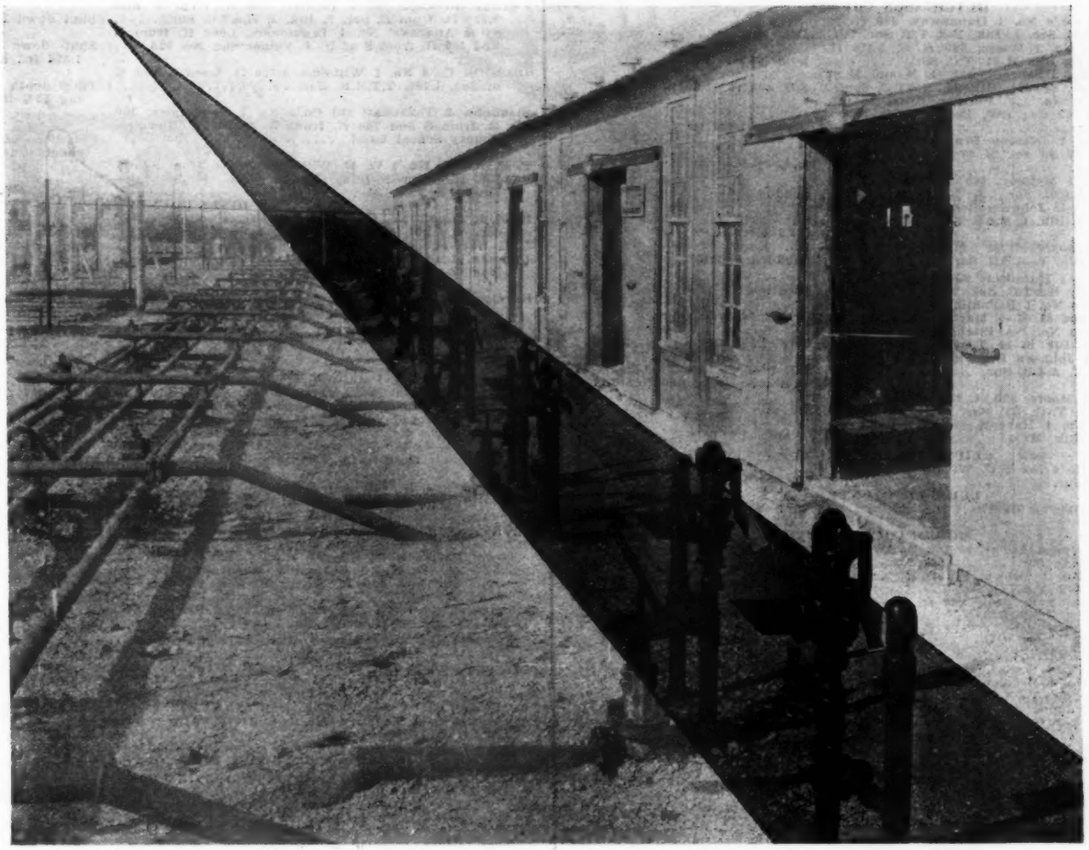
Magnolia Pet. Co.'s No. 4 Latham, 300 ft. N, 320 ft. E, Sec. 153, Blk. 3, I.&G.N. Sur. — Rig up standard tools 2,345 ft.

Magnolia Pet. Co.'s No. 1 Eddington, 330 ft. N, 370 ft. E, NE, Sec. 34, Blk. B-2, H.&G.N. Sur. — To set 6-in. csg. after 8-in. collapsed at 2,625 ft.

Magnolia Pet. Co.'s No. 1 Morse, 330 ft. N and W, S½ NE, Sec. 5, Blk. 26, H.&G.N. Sur. — S.D. 2,631 ft.

McIlroy Oil Co.'s No. 1 Baer, 330 ft. S and W, Sec. 125, Blk. 3, I.&G.N. Sur. — Drlg. plug 2,640 ft.

EVIDENCE



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Nelson et al's No. 1 Crews, 330 ft. S and E, NW, Sec. 13, Blk. 25, H.&G.N. Sur. ... Fishing for bit; T.D. 2,620 ft.
Operators Royalty & Prod. Co.'s No. 2 Vanniman, 330 ft. S and W, E½ NE, Sec. 175, Blk. 3, I.&G.N. Sur. ... Set 8-in. csg. 2,787 ft.
Sanders et al's No. 1 Wright, 330 ft. S, 114 ft. E, Sec. 12, Blk. 3, I.&G.N. Sur. ... Rotary rig.
W. A. Scott's No. 1 Cobb, 330 ft. S, 425 ft. W, N½ SE, Sec. 184, Blk. 3, I.&G.N. Sur. ... Drlg. 3,380 ft.
Skelly O. & G. Co.'s No. 1 Henston, 330 ft. N, 330 ft. E, Sec. 164, Blk. 3, I.&G.N. Sur. ... Location.
Stanolind O. & G. Co.'s No. 2 Cobb, 330 ft. S and E, Sec. 165, Blk. 3, I.&G.N. Sur. ... Spud 72 ft.
Sullivan & Ochiltree's No. 1-A Morse, 330 ft. S and W, N½ NE, Sec. 15, Blk. A-9, H.&G.N. Sur. ... S.D.
The Texas Co.'s No. 1 Webb, 330 ft. S and E, Sec. 12, Blk. 26, H.&G.N. Sur. ... Bldg. rig.
Warner Oil Co.'s No. 1 Morse, 330 ft. S and W, N½ NW, Sec. 68, Blk. 25, H.&G.N. Sur. ... Cellar.

HUTCHINSON COUNTY

Canadian River Gas Co.'s No. 1 Dunnaway, 330 ft. N, 1,320 ft. E, NE NE, Sec. 5, Blk. Y-2, T.T. Sur. ... Drlg. 1,975 ft.
Continental Oil Co.'s No. 1 Moore, 990 ft. S, 2,276 ft. W, S½ SW, Sec. 21, Blk. M-21, T.C. Sur. ... Drlg. 740 ft.
Deal O. & G. Co.'s No. 2 Sanford, 330 ft. N and E of N 80 ac., S 160 ac., Sec. 81, Blk. 46, H.&T.C. Sur. ... S.D. 450 ft. (SLM).
Dixon Creek Oil Co.'s No. 1-F Johnson Bros., 330 ft. N and E of W 67 ac., SW, Sec. 15, Blk. XO3, H.&O.B. Sur. ... Fishing 2,321 ft.
Huber Prod. Co.'s No. 1 Johnson Bros. (Premier), 330 ft. N and E of W 60 ac., N 80 ac., NW, Sec. 3, Blk. Y, A.&B. Sur. ... Drlg. 200 ft.
Huber Pet. Co.'s No. 1 McIlroy, 330 ft. S, 330 ft. W, Sec. 28, Blk. Y, A.F.B. Sur. ... Spud.
Liner Drlg. Co.'s No. 1-D Johnson Bros., 330 ft. N and E, W½ SW, Sec. 6, Blk. 1, B.&B. Sur. ... S.D. 2,990 ft; 20,000,000 ft. gas 2,974 ft.
Liner et al's No. 1 Johnson Bros., 990 ft. S, 330 ft. E, W½ SE, Sec. 29, Blk. Y, A.&B. Sur. ... Spudded and S.D.
Phillips Pet. Co.'s No. 1 Hamilton, 990 ft. E, 1,650 ft. S, Sec. 22, Blk. 47, H.&T.C. Sur. ... Location.
Stanolind O. & G. Co.'s No. 1 Barnhill, common cor. of Tracts 28, 29, 30 and 31 of G. Martinez Sur. Blk. 2 ... Drlg. 3,060 ft.
Stanolind O. & G. Co.'s No. 2-A Pitcher, 990 ft. S, 330 ft. W, SE, Sec. 19, Blk. M-21, T.C.R.R. Sur. ... Drlg. 2,380 ft.
Skelly Oil Co.'s No. 1 Johnson Bros., 660 ft. S and W, SE, Sec. 30, Blk. Y, A.&B. Sur. ... S.O. 3,065 ft. and 3,108-10 ft; S.D. for pipe line connection 3,110 ft.

The Texas Co.'s No. 1 Moore, 990 ft. N, 330 ft. W, SE, Sec. 21, Blk. M-21, T.-C. Ry. Sur. ... Rig up.
Texlivania Oil Co.'s No. 1 Harvey, 330 ft. N and W, SW NW, Sec. 14, Blk. M-21 ... Fishing 2,340 ft.

LIPSCOMB COUNTY

Okla. Public Service Co.'s No. 1 C. W. Jones, NE SW, Sec. 100, H.&T.C. Sur. ... T.D. 5,003 ft.

LUBBOCK COUNTY

Center Oil Co.'s No. 1 Bowles Ranch ... Small S.O. 1,133-40 ft; S.D. 4,167 ft.

MOORE COUNTY

Cloud & Dana's No. 1 Jones, 330 ft. N and E, SW, Sec. 169, Blk. 3-T, T.&N.O. Sur. ... Drlg. 2,925 ft.
Continental Oil Co.'s No. 1 Brown, 990 ft. N and W, SE, Sec. 172, Blk. 3-T, T.&N.O. Sur. ... Drlg. 2,637 ft; set 8-in. csg.
Dana O. & G. Co.'s No. 1 R. Utey, 330 ft. S and W, NE, Sec. 135, Blk. 3, T.&N.O. Sur. ... Rig up; standard tools 2,571 ft.
Gulf Prod. Co.'s No. 2 Kilgore, C SE, Sec. 29, Blk. P.Mc., E.L.R.R. Sur. ... Drlg. 2,222 ft.
Sunray Oil Co.'s No. 1 Rupert, 660 ft. N, 330 ft. E, NW, Sec. 191, Blk. 3-T, T.&N.O. Sur. ... Cellar.
Plains Holding Co.'s No. 1 Bridges, 1,690 ft. S and E, NW, Sec. 252, Blk. 3-T, T.&N.O. Sur. ... S.D. 2,085 ft; wtr. well.
Sunray Oil Co.'s No. 2 Jones, 330 ft. S, 990 ft. E, W½ SW, Sec. 164, Blk. 3-T, T.&N.O. Sur. ... Rig on ground.

MOTLEY COUNTY

Matador Oil Corp.'s No. 1 Owens, C NE, Sec. 10, Blk. G, B.&B. Sur. ... S.D. 580 ft.

OLDHAM COUNTY

Amalgamated German-American Oil Corp.'s No. 1 Norton, 330 ft. S and E, Sec. 12, T.&N.O. Sur. ... Spudded and S.D.
Chambers et al's No. 1 Herring, CNL, Sec. 29, Blk. 8, G.C.&S.F. Sur. ... Drlg. 900 ft.

POTTER COUNTY

Canadian River Gas Co.'s No. 1-B Crawford ... Fishing 2,250 ft.

WHEELER COUNTY

Devore & Robinson's No. 1 Sitter, 2,310 ft. S and E, Sec. 33, Blk. 24, H.&G.N. Sur. ... U.R. 8-in.; gas 2,020-30 ft; 28,000,000 ft. gas at 2,075 ft.

Reno Oil Co. et al's No. 1 D'spain, 330 ft. N and W, NE, Sec. 52, Blk. 24, H.&G.N. Sur. ... U.R. 8-in. 1,675 ft.
Vollmert's No. 1 Porter, 330 ft. S and E, NE, Sec. 15, Blk. 27, H.&G.N. Sur. ... Rigged up and S.D.

WILDCAT OPERATIONS IN WEST TEXAS

(Continued from Page 70)

CULBERSON COUNTY

Cranfill Bros. and Sholts' No. 1 Seay, 2,310 ft. from S and W, Sec. 45, Blk. 60, Public School Land ... Shut down 1,365 ft.
Grisham & Hunter's No. 2 Garren, 2,475 ft. from S and 1,566 ft. from E, Sec. 20, Blk. 89, Public School Land ... Shut down 2,500 ft.
Kornrumpf et al's No. 1 Garren, 330 ft. S and W, Sec. 15, Blk. 79, Public School Land ... Shut down 1,240 ft.

DAWSON COUNTY

Albaugh et al's No. 1 Robinson, C NW, Sec. 46, Blk. M, E.L.&R.R. Sur. ... Spudded 20 ft. and shut down.

ECTOR COUNTY

Galt, Brown & Penn's No. 1 Cowden, C SE, Sec. 12, Blk. 44, Twp. 3s, T.&P. Sur. ... Shut down 180 ft.
H. F. Wurts' No. 1 E. A. Ibbetson et al, 330 ft. from N and E lines of NW, Sec. 16, Blk. 46, Twp. 3s, G. M. M.Br.&A. Sur. ... Shut down 3,275 ft.
Southern Crude Oil Pur. Co.'s No. 2 Crowder & Co., 660 ft. from S and W of NE cor., Sec. 34, Blk. 43, Twp. 1n, T.&P. Sur. ... Fishing 3,795 ft.

EL PASO COUNTY

Lane-The Texas Company's No. 1 Malone, 2,110 ft. from SW and NW of Sec. 46, J. M. Day Sur. ... Shut down 3,089 ft.
Tri-State Oil Co.'s No. 1 Bobadella, 1,325 ft. from S and E lines, Sur. No. 254, S.F. No. 7,247 ... Drlg. 540 ft.

FISHER COUNTY

Roeser & Pendleton's No. 1 Gribble (Russell), 660 ft. from S and 440 ft. from W of NW, Sec. 210, B.B.B. &C. Sur. ... Drlg. 2,330 ft.

GAINES COUNTY

Texas Consolidated Oil Co. et al's No. 1 Jones, 2,310 ft. from NE, Sec. 4, Blk. A-8, P.S.L. Sur. ... Drlg. 1,530 ft.

GARZA COUNTY

Pandem Oil Corp.'s No. 1 Justice, 330 ft. from S and W of Sec. 12, Blk. 4, H.&G.N. Sur. ... Spudded and shut down.
Perry & Posey's No. 1 Justice, 1,980 ft. from S and 1,680 ft. from E of Sec. 25, Blk. 6, H.&G.N. Sur. (2,500-ft. cable tool test) ... Rig.

GLASSCOCK COUNTY

World Oil Co.'s No. 3-C McDowell, 2,310 ft. from S and W of NE cor., Sec. 21, Blk. 34, Twp. 2s, T.&P. Sur. ... Temp. aband.; total depth 660 ft.

HOWARD COUNTY

Continental Oil Co.'s No. 1 Brindley, 660 ft. from S and E of Sec. 18, Blk. 33, Twp. 1s, T.&P. Sur. ... Rigging up.
G. F. Getty's No. 1 Snyder, Sec. 27, Blk. 10, Twp. 1s, SW cor. NE NE ... Shut down 3,500 ft.
Green O. & R. Co.'s No. 1 Denman, 990 ft. from S and 2,310 ft. from W, Sec. 14, Blk. 30, Twp. 1s, T.&P. Sur. ... Spudded and shut down.
Group No. 1 Oil Corp.'s No. 2 Eason, 1,320 ft. from S and W, Sec. 6, Blk. 32, Twp. 2s, T.&P. Sur. ... Swabbed 37 bbls. per hour for 2 hours; total depth 2,444 ft.

Moody Oil Corp.'s No. 33-B Roberts, 990 ft. from N and W of Sec. 137, Blk. 29 ... Temp. aband. 261 ft.

HUDSPETH COUNTY

Patillo & Welch's No. 1 Briggs, 300 ft. from S and W, Sec. 13, Blk. 73, Twp. 7, T.&P. Sur. ... Drlg. 100 ft.
Theison's No. 1 University, 3,050 ft. from S and 2,225 ft. from E of Sec. 17, Blk. E ... Spudded 35 ft. and shut down.

IRION COUNTY

Central Oil Co.'s No. 2 Horney, 150 ft. from N and 1,320 ft. from E, Sec. 3, Blk. 3, H.&T.C. Sur. ... Shut down 1,360 ft.
Denny & Andrews' No. 1 Tankersley, 1,000 ft. from E and 460 ft. from S of H. J. Volker Sur. No. 723 ... Shut down 1,374 ft.; show oil 1,367 ft.; half full salt water.

Dixie Oil Co.'s No. 1 Williams, 1,320 ft. from S and E of Sec. 1,196, T.T.R.R. Sur. ... Total depth 1,650 ft.; underreaming 13⅜-in. casing.

Straughn & Texannati Oil Co.'s No. 1 Tankersley, 150 ft. from S and 750 ft. from W of Sec. 4, Gonzales County School Land ... Plugging back to 1,220 ft. to shoot; total depth 1,506 ft.

F. F. Webb's No. 1 W. H. Williams, 200 ft. from E and 750 ft. from S line, SW NE, Sec. 10, Gonzales County School Land ... Shut down 100 ft.

JONES COUNTY

Bond & Trout's No. 1 Williams, 330 ft. S and E of SW cor. of J. W. Martin Sur. A-1,308 in Sec. 12 ... Cleaning out 2,571 ft.
J. L. Hart et al's No. 1 Roberts ... Total depth 1,000 ft.
Jameson et al's No. 1 King, 4,681 ft. from S and 150 ft. from E of M. Bueno Sur. No. 196 ... Total depth 1,550 ft.; will junk hole and skid.

Hardly Able Oil Co.'s No. 1 Butter, 5,790 ft. from S and 330 ft. from E of W. Littlefield Sur. No. 282, Abst. 251 ... Spudding.
Shaheen and Prairie O. & G. Co.'s No. 1 King, 165 ft. N and 150 ft. W of SE cor., Lot 7, B. Bueno Sur. No. 197 ... Location.
Shaheen et al's No. 1 Chittim, 165 ft. from S and W of 139.8-acre farm in G. Martinez Sur. No. 195 ... Drlg. 1,350 ft.
Union Oil Co. of Nevada and Shaheen's No. 1 King, 200 ft. from N and W, Lot 5, M. Bueno Sur. No. 197 ... Cleaning out 2,166 ft.
Yingling et al's No. 1 Williams, 330 ft. N and E of SE cor. of Cade 160-acre tract but in Williams 200-acre farm, Sec. 17, Blk. 19, T.&P. Sur. ... Drlg. 1,860 ft.

LOVING COUNTY

Douglas et al's No. 1 Wheat & Ramsey, 330 ft. from SE and 2,310 ft. from SW, Sec. 83, Blk. 1, W.&N.W. Sur. ... Drlg. 3,585 ft.
Eppenauer et al's No. 2 Allen, 2,310 ft. from NE and 330 ft. from NW, Sec. 90, Blk. 1, W.&N.W. Sur. ... Drlg. 4,040 ft.
Falbre & Evans' No. 1 Dean, 330 ft. from NE and 990 ft. from NW, Sec. 79, Blk. 33, H.&T.C. Sur. ... Drlg. 645 ft.
Henshaw et al's No. 2 Reagan & McElvain, 1,650 ft. from SW and 990 ft. from SE, Sec. 84, Blk. 7, W.&N.W. Sur. ... Rig.
Hoffman et al's No. 1 Ramsey et al, 330 ft. NE and SE Sec. 83, Blk. 1, W.&N.W. Sur. ... Drlg. 425 ft.
Hoffman et al's No. 2 Ramsey et al, 2,310 ft. from NE and 330 ft. from SE, Sec. 83 ... Rig.
Irwin and others' No. 1 Auld, 1,825 ft. from NE and 1,298 ft. from NW, Sec. 67, Blk. 1, W.&N.W. Sur. ... Cellar.
Lockhart & Co.'s No. 3 Bowen & Wells, 330 ft. from NE and SE of Sec. 92, Blk. 1, W.&N.W. Sur. ... Shut down 4,050 ft.
Lockhart & Co.'s No. 2 fee, 676 ft. S, 330 ft. W, Sec. 91, Blk. 1, W.&N.W. Sur. ... Rigged up and shut down.
Lockhart's No. 1 Hubbard, 6,930 ft. from NE and 330 ft. from SE, Sec. 83, Blk. 33, H.&T.C. Sur ... Drlg. 3,555 ft.
Lockhart & Co.'s No. 3 Hubbard, 1,650 ft. from NE line, 330 ft. NW line of Sec. 33, H.&T.C. Sur. ... Rigged up and shut down.
Rush et al's No. 1 Wheat, 330 ft. from NW and SW, Sec. 77, Blk. 1, W.&N.W. Sur. ... Cellar.
Slagel Drlg. Co.'s No. 1 Cartwright et al, 2,310 ft. from S and 990 ft. from W, Sec. 1, Blk. 57, Twp. 1, T.&P. Sur. ... Shut down 2,914 ft.
Tennant et al's No. 1 Martin, 990 ft. from NW and SW Sec. 66, Blk. 1, W.&N.W. Sur. ... Rig.
California Co.'s No. 2 Allen, 2,310 ft. from SE and SW lines, Sec. 90, Blk. 1, W.&N.W. Sur. ... Drlg. 2,380 ft.
California Co.'s No. 3 Allen, 2,191 ft. from NW and 2,183 ft. from SW, Sec. 90, Blk. 1, W.&N.W. Sur. ... Building rig.
California Co.'s No. 4 Allen, 3,121 ft. from NW and 3,113 ft. from SW, Sec. 90, Blk. 1 ... Moving in material.
California Co.'s No. 7 Reagan & McElvain, 2,031 ft. from SE and 1,014 ft. from NE of Sec. 84, Blk. 1, W.& N.W. Sur. ... Total depth 4,349 ft.; 3,300 ft. oil in hole; testing.

West Texas Pet. Corp.'s No. 1 Salsbury, 330 ft. from NW and SW, Sec. 89, Blk. 1, W.&N.W. Sur. ... Drlg. 960 ft.

MENARD COUNTY

Priest's No. 1 Sorrell, 1,000 ft. from E and 200 ft. from S cor., Sec. 132, E.L.R.R. Sur. ... Drlg. 102 ft.

MITCHELL COUNTY

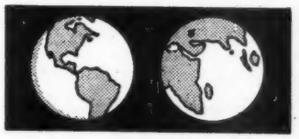
Lewis & Slagel's No. 1 Bell ... Cleaning out 2,820 ft.; swabbing 60 bbls. oil daily; total depth 2,827 ft.

PECOS COUNTY

Cardinal Oil Co.'s No. 1 White & Baker, 990 ft. from N and 990 ft. from E, Sec. 47, Blk. 194, T.C.&S.F. Sur. ... Drlg. 102 ft.
Culberson Bros.' No. 1 Toppett (Humble), 150 ft. S and 843 ft. E of C Sec. 40, Blk. 194, G.C.&S.F. Sur. ... Location.
Dittman's No. 1 Jackson, 2,310 ft. from NE and 330 ft. from NW, Sec. 28, Blk. 3, H.&T.C. Sur. ... Shut down 1,412 ft.
Disney & Gholson's No. 1 C. O. Wilson, 330 ft. from S and 330 ft. from W, Sec. 27, Blk. 142, T.&St.L. Sur. ... Location.
Humble Oil & Ref. Co.'s No. 1 Kokernot, 1,320 ft. from N line and 1,467 ft. from W line of Sec. 227, Blk. 10, G.H.&S.A. Sur. ... Total depth 6,180 ft.; cem. whipstock 5,100 ft.

Lancaster's No. 1 Eaton (Pure), 330 ft. from SE and SW, Sec. 35, Blk. 3, H.&T.C. Sur. ... Shut down 965 ft.
Magnolia Pet. Co.'s No. 1 Eaton, 2,310 ft. from SW and 330 ft. from NW, Sec. 35, Blk. 3, H.&T.C. Sur. ... Underreaming 6⅝-in. casing 1,425 ft.
McCurdy & Brown's No. 2 Tippett, 150 ft. from N and W of SE, Sec. 40, Blk. 104, G.C.&S.F. Sur. ... Location.
McCarty Oil Co.'s No. 3 Gray, 700 ft. from N and 2,260 ft. from W, Sec. 591, G.C.&S.F. Sur. ... Fishing 1,437 ft.
Messenger et al's No. 1 Butz, 1,830 ft. from NW and 1,170 ft. from SW, Sec. 54, Blk. 10, H.&G.N. Sur. ... Shut down 1,299 ft.
J. R. Miller et al's No. 1 Bennett, 359 ft. W of CWL, Sec. 1, Blk. 119, G.C.&S.F. Sur. ... Shut down 2,283 ft.
Penn Oil Co. et al's No. 1 Alvis, 2,358 ft. from S and 1,327 ft. from W, Sec. 155, Blk. 3, T.&P. Sur. ... Drlg. 2,075 ft.
Perren Oil Co.'s No. 2 Eaton, C of E, Sec. 27, Blk. 3, H.&T.C. Sur. ... Drlg. by tools 1,765 ft.
Pure Oil Co.'s No. 1 Harrison, 2,310 ft. from N and 330 ft. from W of Sec. 203, Blk. 3, T.&P. Sur. ... Shut down 5,000 ft.
Riser & White's No. 1 Riser, 2,297 ft. from S and 997 ft. from E of Sec. 24, Blk. 12, H.&G.N. Sur. ... Shut down 500 ft.

OUR
ADVERTISING POLICY



TELL THE WORLD

1 WHO WE ARE
2 WHAT WE MAKE
3 HOW *WELL* WE MAKE IT

1. The KM CO trademark represents twenty-five years of experience in manufacturing equipment for the Producing, Transporting and Refining Divisions of the Oil Industry. This begins with the conception and follows through the design up to the finished product, with years spent studying the working problems of finished equipment and perfecting improvements therefor. A full complement of warehouses and sales representatives. Export office: 150 Broadway, New York City.

2. STEEL TANKAGE, FLOATING ROOFS, TANK FITTINGS, CONDENSER BOXES, AGITATORS, STILLS, STEEL PLATE CONSTRUCTION, SEMI-STEEL CASTINGS, Steel Derricks, Rig Irons, Bull Wheels, Band Wheels, Crown Blocks, Combination Drilling and Pumping Unit, Tug Wheels, Sand Reels.

3. Only high quality materials go into KM CO equipment, including semi-steel castings, bronze bushings, and aluminum paint protection. All points of strain and wear are reinforced, moving parts rugged, extra-large and accessible. A. P. I. Specifications are followed throughout. All KM CO equipment is noted for long life and low maintenance cost.

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General Offices: IOLA, KANSAS

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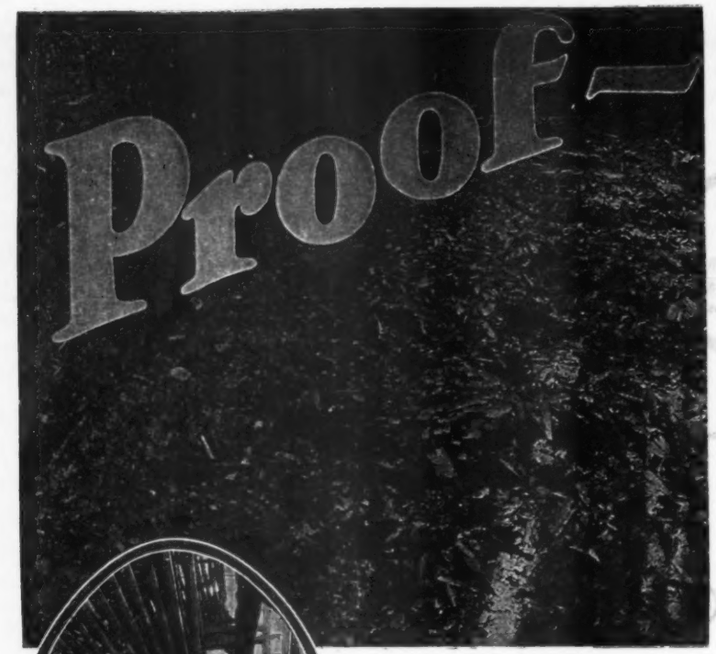

G-R Bentube Sections Shed Scale *Automatically*

THE large masses of scale which completely cover the bottom of this cooling tower pit were *automatically* shed from G-R Bentube Atmospheric Sections. The superintendent of this plant tells us that at no time since the Bentube Sections were installed has it been necessary to resort to mechanical cleaning to remove scale from the sections.

This unique feature of G-R Bentube Sections is due to their exclusive construction of Admiralty Metal tubes set with an initial curvature into cast iron headers. The changes in temperature that occur during normal operation cause expansion and contraction of the tubes, and the corresponding changes in their curvature keep scale from building up to any material thickness.

The G-R Bentube Section is patented and it is our intention to prosecute all infringements. Infringement suits have already been filed in two instances.

The Griscom-Russell Co.
285 Madison Ave., New York
Branches in all oil centers.

Griscom-Russell
Heat Transfer Apparatus

California Co. et al's No. 1 Thomas, 990 ft. from NW and SW, Sec. 31, Blk. 34, H.&T.C. Sur. — Location.
The Texas Company's No. 1 Wright, 660 ft. S and E of NW cor., Sec. 9, Blk. 131, T.&St.L. Sur. — Shut down 3,504 ft.

REAGAN COUNTY

Big Lake Oil Co.'s No. 6-C University, 1,120 ft. S and 1,100 ft. from W, Sec. 25, Blk. 9 — Location.

REEVES COUNTY

R. T. Hansford's No. 1 Williams, 150 ft. from S and W, Sec. 17, Blk. 6, H.&G.N. Sur. — Shut down 380 ft.
Riggs & Smith's No. 1 Lee Monroe, 2,190 ft. from NE and 330 ft. from NW line, Sec. 34, Blk. 8, H.&L.N. Sur. — Shut down 264 ft.; junked hole to skid.
Salsbury & Gregory's No. 1 Young Bell, 1,170 ft. from N and 330 ft. from NW line, Sec. 34, Blk. 7, H.&L.N. — Temporarily abandoned.
Lee O. White et al's No. 1 Hershersor, 330 ft. from N and W lines of Sec. 5, Blk. 51, Twp. 10, T.&P. Sur. — Shut down 4,415 ft.
California Co.'s No. 2 Kloh & Rumsey, 990 ft. from S and 1,520 ft. from E, Sec. 11, Blk. 54, Twp. 4, T.&P. Sur. — Cem. 16-in. casing 1,135 ft.; total depth 1,180 ft.

RUNNELS COUNTY

Dutton et al's No. 1 Dean, 5,475 ft. from NE and 1,048 ft. from NW in J. Heil Sur. No. 419 — Shut down 2,175 ft.

SCHLEICHER COUNTY

Eastland Oil Co.'s No. 1 Joe Tisdale, C Sec. 29, Blk. M, G.H.&S.A. Sur. — Drlg. 1,400 ft.
Teas & Gant's No. 1 Allison, 1,320 ft. N and E of SW cor., Sec. 37, Blk. K, G.H.&S.A. Sur. — Shut down 5,006 ft., contract depth.
Wesner et al's No. 1 Nicks, 2,310 ft. from N and 2,362 ft. from E of Sec. 77, Blk. LL, T.C. Sur. — Fishing 1,060 ft.
George Wilson's No. 1 Page, Sec. 40, Blk. L, 1,290 ft. from N, 1,470 ft. from W, G.H.&S.A. Sur. — Shut down 5,027 ft.

SCURRY COUNTY

G. E. Dickman and R. B. Pender et al's No. 1 F. C. Davis, 1,000 ft. N and 1,770 ft. W of SE cor. of Sec. 275, Blk. 2, H.&T.C. Sur. — Drlg. 5,000 ft.
Scurry County Oil Exchange's No. 1 Earnest, 2,310 ft. from N and W, Sec. 68, Blk. 3, H.&G.N. Sur. — Spudded and shut down.
Seifert & Dibble's No. 1 T. M. Blackburn, 2,310 ft. from N and 2,310 ft. from W line of Sec. 155, Blk. 97, H.&T.C. Sur. — Running 6⅝-in. casing 2,376 ft.

STERLING COUNTY

Beesley et al's No. 1 Foster, 2,940 ft. N and 300 ft. W of SW cor., Sec. 7, Blk. 22, E.&T.C. Sur., but in Sec. 16, Blk. 31, Twp. 4s, T.&P. Sur. — Fishing for underreaming lugs; total depth 637 ft.

TAYLOR COUNTY

John B. Jameson's No. 1 Webb, 1,170 ft. S and W of NE cor., Sec. 46, Lunatic Asylum Land — Drlg. 6,285 ft.
Sanger et al's No. 1 City of Abilene, 830 ft. from S and 1,400 ft. from E of Sec. 66, Blind Asylum Land — Shut down 2,785 ft.

TERRELL COUNTY

Big Bend Oil Co.'s No. 1 Bassett, C NW, Sec. 155, Blk. D, M.-K.-T.- Sur. — Shut down 2,669 ft.
Keck Pecos Trust Co.'s No. 1 Hamilton, C. Sec. 6, Georgetown Ry. Sur. — Shut down 3,150 ft.
Miller Bros.' No. 1 Allison & Burke, C NW cor., Sec. 10, Blk. 176, T.&P. Sur. — Shut down 120 ft.
Mrs. J. B. McPhees' No. 1 Sam Belt, C, Sec. 16, Blk. D-7, E.L. Sur. — Shut down 880 ft.; moved off machine.
Transcontinental Oil Co.'s No. 1 Goode, 2,152 ft. from E and 330 ft. from S, Sec. 26, Blk. 161, G.C.&S.F. Sur. — Gauged 6,500,000 ft. of gas 5,6[illegible] ft.; shut down 5,612 ft.; ready to start up.
Woodley & Jones' No. 1 Pankenham, C SE NW, Sec. 43, Blk. B-2, C.C.S.D.&R.G.N.G. Sur. — Shut down 625 ft.

TOM GREEN COUNTY

Belding & Dutton's No. 1 Norsworthy, 2,640 ft. from S and 587 ft. from E of John McNeese Sur. — Shut down 760 ft.; show oil and gas 725 ft.
Fitzgerald & Taliaferro's No. 1 Bennett, C SW, Sec. 1,628, E. H. Dinger Sur. — Plugged back to 2,405 ft. to straighten hole; shut down 2,4[illegible] ft.
Mintex Oil Co.'s No. 1 Campbell Est., 446 ft. from S and 630 ft. from W of Sec. 180, Dist. No. 11, S.P. Sur. — Shut down 1,994 ft.
Pratt & Hancock's No. 2 Lewis, 100 ft. N and 330 ft. E of most northerly SW cor. of Joshua S. Grant Sur. No. 2 — Shut down 200 ft.

UPTON COUNTY

Duffey and others' No. 1 McClintic, 990 ft. from N and 330 ft. from E, T.C.S.D.&R.G.N.G. Sur. — Building rig.
Farley et al's No. 1 Lane, 330 ft. from S and W of NW, Sec. 36, Blk. 1, M.-K.-T. Sur. — Drlg. 2,005 ft.
T. P. Coal & Oil Co.'s No. 1 King Ranch Oil & Lignite Co., 3,310 ft. from N and 990 ft. from W, Sec. 28, Blk. 2, M.-K.-T. Sur. — Preparing to shoot 2,815 ft.

VAL VERDE COUNTY

Independent Operators' No. 1 Whitehead, SE SE, Sec. 10, Blk. 4, I.&G.N. Sur., elev. 1,175 ft. — Shut down 5,360 ft.
O. O. Owens' No. 1 Mills, Sec. 128, Blk. 1, I.&G.N. Sur., elev. 2,130 ft. — Waiting for cement to set 6,750 ft.

WARD COUNTY

Bradford et al's No. 1 Carson, 990 ft. from NE and SE Sec. 26, Blk. 5, H.&T.C. Sur. — Total depth 210 ft.
Beckley and others' No. 1 Johnson, 4,140 ft. from NE and 990 ft. from SE, Sec. 8, Blk. 32, H.&T.C. Sur. — Location.
Chester & Smith's No. 1 Booger, 1,200 ft. from SE and 150 ft. from SW Sec. 11, Blk. 5, H.&T.C. Sur. — Spudding.
Gibson & Johnson's No. 1 Johnson, 330 ft. from NE and 661 ft. from SE, Sec. 10, Blk. 32, H.&T.C. Sur. — Machine.
Gulf Prod. Co.'s No. 3 Wristen Bros., 220 ft. NE of SW and 220 ft. SE of NW, Sec. 18, Blk. 5, H.&T.C. Sur. — Show gas 1,960-70 ft.; filling up with sulphur water 2,520-77 ft.; salt water 2,515 ft.; plugged back to 2,477 ft.
Gulf Prod. Co.'s No. 16 O'Brien, 2,310 ft. from S and 990 ft. E, Sec. 16, Blk. F, L.M.&W.B.&A. Sur. — Fishing 2,545 ft.
Magnolia Pet. Co.'s No. 1 Sealy (Atlantic), 2,130 ft. from S and 1,650 ft. from E, Sec. 45, Blk. F, G.M.M.B.&A. Sur. — Drlg. 1,520 ft.
R. F. Owens' No. 1 Johnson, 100 ft. from NE and 1,100 ft. from SE of Sec. 8, Blk. 33, H.&T.C. Sur. — Drlg. 2,225 ft.
Prairie O. & G. Co.'s No. 1 Hill, 330 ft. from NE and NW, Sec. 30, Blk. B-29, P.S.L. Sur. — Drlg. 2,330 ft.; top pay 2,285 ft.; 500 ft. oil in hole.
Paul Ryan's No. 1 Allen, 998 ft. from NW and 3,624 ft. from NE, Sec. 11, Blk. 5, H.&T.C. Sur. — Drlg. 2,060 ft.
Shipley et al's No. 5 Hayzlett, 2,490 ft. from SE and 1,980 ft. from SW, Sec. 17, Blk. 5, H.&T.C. Sur. — Drlg. 2,350 ft.
California Co. et al's No. 1 Lanham, 990 ft. from NE and SE, Sec. 35, Blk. 34, H.&T.C. Sur. — Building rig.
California Co.'s No. 1 Gordon, 330 ft. from NE and SE, Sec. 6, Blk. 34, H.&T.C. Sur. — Drlg. 520 ft.
Shipley et al's No. 1 Monroe, 330 ft. SE SW, Sec. 3, Blk. 1 — Drlg. by bit 3,785 ft. and cleaning out.

WINKLER COUNTY

Magnolia Pet. Co.'s No. 1 Bashara, 1,650 ft. from S and 2,310 ft. from W, Sec. 17, Blk. B-3, P.S.L. Sur. — Drlg. 3,102 ft.; 700 ft. oil in hole.
Magnolia Pet. Co.'s No. 1 Walton, 2,310 ft. from N and W, Sec. 16, Blk. 77, P.S.L. Sur. — Preparing to cement 8¼-in. casing.
Liner Drlg. Co.'s No. 1 Campbell, 330 ft. from N and E cor., Sec. 2, Blk. B-5 — Shut down 4,639 ft.

COLUMBIAN

FIRE and EVAPORATION—the oil marketers' most dangerous enemies—are practically eliminated thru the use of COLUMBIAN FLOATING DECKS. Floating on the oil at all levels these flexible air-tight seals not only prevent the formation of combustible vapors, but at the same time will retain highest gravity of the oil in storage by stopping evaporation of the lighter fractions.

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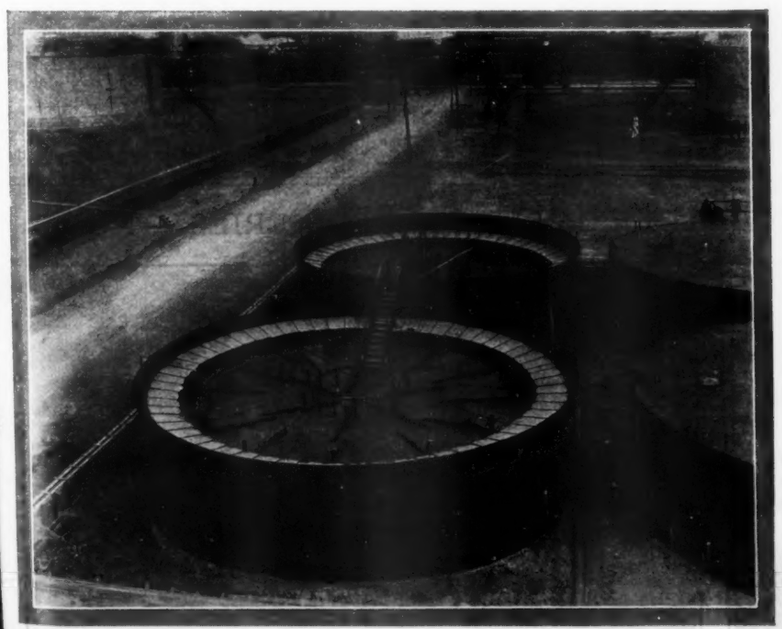
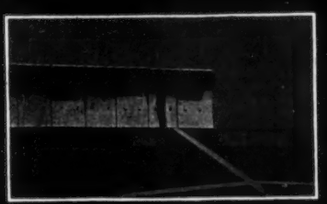
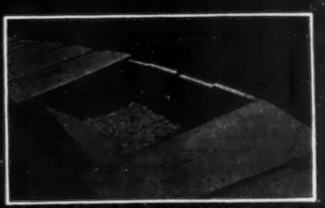
B. W. Deane, Port of Spain, Trinidad, B. W. I.
General Supply Company, S. A., Mexico D. F., Mexico
Agencias, Atlas, S. A., Tampico, Tamps, Mexico
F. E. Richardson & Co., Honolulu, Hawaii
P. B. Heeney, Apartado 298, Maracaibo, Venezuela



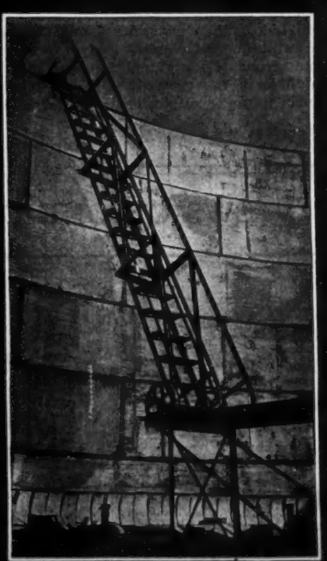
Gravel-Seal covers in service.



Section of sub-structure on outer rim.



Gravel-Seal with covers removed, showing gravel in place.



Self adjusting tread stair in lowest position.

CHARACTERISTICS OF HYDROGEN SULPHIDE

(Continued from Page 154)

the animals. The concentration of 0.01 per cent was distinctly irritating to men who were exposed to this concentration. Certainly men should not be exposed to anything more than a trace, or about 0.005 per cent, and prolonged exposure to this quantity may prove fatal.

When hydrogen sulphide is taken into the body it combines with the sodium in the cells to form sodium sulphide[9]. Irritation follows because of the abstraction of the alkali and by the sodium sulphide which is caustic to the flesh. Part of the sodium sulphide is absorbed through the membranes of the respiratory system and enters the blood stream. It is there decomposed with the liberation of hydrogen sulphide. If hydrogen sulphide is passed through blood a dark green pigment is deposited, probably a compound formed by the union of sodium sulphide and the iron of the blood.

The vapors and gases from numerous crude oils, together with the various distillates from petroleum, usually contain organic sulphur compounds from which large quantities of hydrogen sulphide are evolved. When substances of this character come in contact with iron there is a tendency for the sulphur and the iron to combine to form iron sulphide.

Explosion and Fire

Freshly formed iron sulphide absorbs oxygen from the air very rapidly and the reaction is accompanied by a sudden rise in temperature. The development of heat is so great that a deposit of iron sulphide may be heated to redness and in the presence of suitable vapors or liquids will cause a fire. When such deposits are formed in agitators, towers, stills, and other favorable places where there are petroleum vapors, explosions and fires frequently result upon the admission of air.

Iron sulphide deposits of this kind are liable to form in the upper parts of tanks and agitators during dry and cold weather conditions. It is a good plan to thoroughly steam a tower before opening it and when some forms of packing have been used with a high sulphur oil, it has been necessary to flood the tower with water before all of the dangerous deposit was removed.

Corrosion

Any quantity of hydrogen sulphide is objectionable and the extent of corrosion depends on the volume of gas handled, which is another way of saying that the action is influenced by the total quantity of hydrogen sulphide. While natural gas does not contain an appreciable quantity of oxygen, the usual refinery gas does. Hydrogen sulphide in the presence of oxygen (air) tends to form sulphuric acid which causes rapid corrosion. In the absence of oxygen the corrosion products are free sulphur and iron sulphide. Both of these localize the corrosion with the result that pitting proceeds at a more rapid rate than a calculation would indicate. Very often pellets of sulphur will collect on the inside of a pipe and the final corroded field will coincide with the shape of these deposits.

The National Tube Research Laboratory determined the penetration of hydrogen sulphide in the presence of water as shown in the table:[10]

TABLE 6—HYDROGEN SULPHIDE PENETRATION OF VARIOUS METALS

Metal—	Days tested	Inches penetration year
Nickel	120	0.00024
Monel metal	120	0.00054
Chrom-steel	120	0.00149
Open hearth steel	120	0.00959
Bessemer steel	90	0.00833
Copper bearing steel	90	0.01114

These results were obtained by bubbling hydrogen sulphide through water in which the pieces of test metal were immersed. The unit of measurement being in terms of average penetration in inches for a year, based on loss in weight of a known area, the area exposed, the weight of the metal per unit volume and the period covered by the test. Frequently hydrogen sulphide will cause pitting or perforation before appreciable quantities of the metal have been removed by corrosion due to the localized action mentioned. Where two opposite sides are exposed, as in valves and fans, the penetration will be twice that of the single exposure.

The removal of hydrogen sulphide from natural gas that is to be transported some distance through a pipe line is important as affecting the life of the line through corrosion. Speller cites[11] as an illustration the two cast iron pipes conveying mineral water from the same place. One of these last 2.5 to 3 years and the other between 20 and 25 years. The only difference in the character of the water was that the one contained 0.5 parts per 1,000,000 hydrogen sulphide and the other none.

Dissociation

When hydrogen sulphide is heated it dissociates, forming free hydrogen and sulphur. This decomposition is quite slow at 590° F., but at 932° F. it is quite rapid. The pure gas is generally said to burn to SO_2, but as the temperature of the flame is much above 590° there is dissociation on the inner part of the flame. This may easily be demonstrated by slowly passing a piece of cold porcelain, or even a glass tube, through the flame. A deposit of free sulphur will be found to be deposited on the cold surface. Hydrogen may also be separated if suitable apparatus is provided.

This reaction explains at least a part of the free sulphur formed from the gas in cracking stills. Also, it accounts for the deposits of sulphur so often observed around the cooler parts of a still when it is opened after a run with a high sulphur oil. The dissociation of hydrogen sulphide is probably one of the sources of the sudden failures of tubes, fittings, etc., while in service. Pyrometer wells that may be set in a high temperature area are liable to fail because of sulphur deposits. The union of the sulphur and the metal causes complete disintegration. The resulting effect appears as pin holes, pitting, and other evidences of corrosion. Failures of this sort are responsible for more explosions and fires than any other cause.

Hyrodgenation

Hydrogenation of high sulphur crude oils appears as a possible method for the removal of excessive quantities of sulphur. One effort of this kind is described by C. E. Waters[12], working with an engine oil containing 0.85 per cent sulphur and a topped Mexican crude of 1.83 per cent sulphur content. An attempt was made to remove sulphur by heating the oil in the presence of a catalyzer and hydrogen. The apparatus was so arranged that a container holding the oil and a catalyzer was heated while a slow current of hydrogen bubbled through the oil and the escaping gas flowed into a sodium hypobromite solution. One catalyzer was made by igniting nickel oxide in hydrogen and the other catalyzer was a circular disc of platinum foil. The experiments were continued for 2.5 hours at a temperature between 320 and 330° C., and "to a much higher temperature, with the thermometer removed, for 3 hours. In the experiments at the higher temperatures the thermometer was removed from the bath when 360° was approached and the flame increased until the oil vapors condensed 5 or 6 c.m. above the cover." The quantity of sulphur obtained in these experiments represented a very small part of the sulphur contained in the oil.

It may be that if the same operation were conducted under considerable pressure, or even above 500° C., that an appreciable conversion would be obtained.

The fundamental principle of this reaction is a part of the hydrogenation process for treating petroleum and other carbonaceous residues, now of special interest to the petroleum industry.

Treating

No commercial system of treating will completely remove hydrogen sulphide from a gas; about 90-95 per cent removal is all that may be expected. Ordinary refinery gas contains from 150 to 500 grains of hydrogen sulphide per 100 cubic feet. Some petroleums from Mexico have yielded as high as 3,000 grains per 100 feet. The ordinary run of natural gas does not contain enough hydrogen sulphide to warrant treating before passing through the compressor.

Refinery gas containing 100 grains per 100 feet on a basis of 1,000,000 feet handled each 24 hours need not be treated, according to some refiners, because the treating expense is considerably more than the corrosion damage. Stoppage of the pipes, etc., due to the accumulation of the free sulphide is a serious danger, which should be controlled by frequent inspection, in addition to the direct corrosion which may occur.

Where the local conditions are favorable and a large supply of cheap water is available, gas may be washed with water. Large quantities of hydrogen sulphide may be removed from gas by simply washing with water because this gas is soluble to the extent of 3.2 volumes in water at 60° F.

Chemicals Used

The chemicals that may be used include caustic soda solutions, iron oxide and hydrate, sodium carbonate, hydrated lime and milk of lime. The economical use of any and all of these will depend upon the location of the supply, or where the gas is to be treated, because of transportation expense, and the quantity of hydrogen sulphide that will have to be removed.

A process for hydrogen sulphide removal from gas has recently been announced in which triethanolamine is the active reagent. It is claimed to possess a specific absorption capacity of 100 volumes of hydrogen sulphide per volume, or when diluted with water has an absorption rate of 75 volumes. This reagent is noninflammable and noncorrosive to iron. It may be recovered, to be used over again, by simply heating to a relatively low temperature, approximately the boiling point of water.

Soda ash is one of the common names often used for the chemical compound sodium carbonate. This substance is the primary material for the removal of hydrogen sulphide, and other substances, from various gases, including natural gas. The sodium carbonate is used in a solution in water, through which the gas is passed. Explaining the process on the basis of hydrogen sulphide removal there are a series of steps or reactions involved.

Koppers Process

The process is covered by patents which are owned by the Koppers Co.

When the gas is first passed through the sodium carbonate solution, sodium bicarbonate and sodium acid sulphide are formed, as follows:

$$Na_2CO_3 + H_2S \rightarrow NaHCO_3 + NaHS$$

The next operation is to blow air through the solution, as a step toward the formation of sodium carbonate and the removal of sulphur from the solution, as shown by the following:

$$NaHCO_3 + NaHS \rightarrow Na_2CO_3 + H_2S$$

The sodium carbonate solution in the

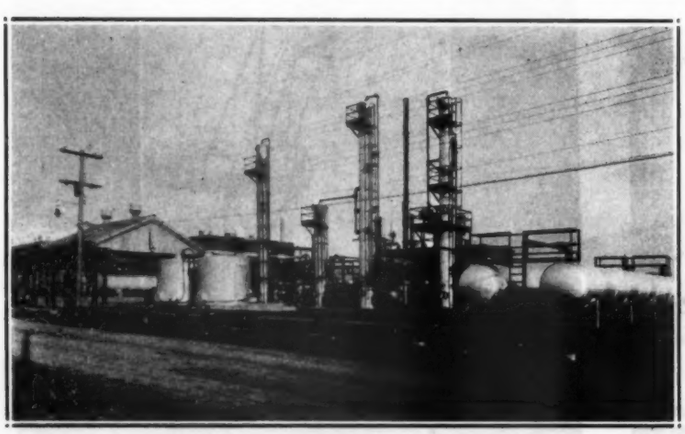
[9]Henderson and Haggard; Noxious Gases, page 189.

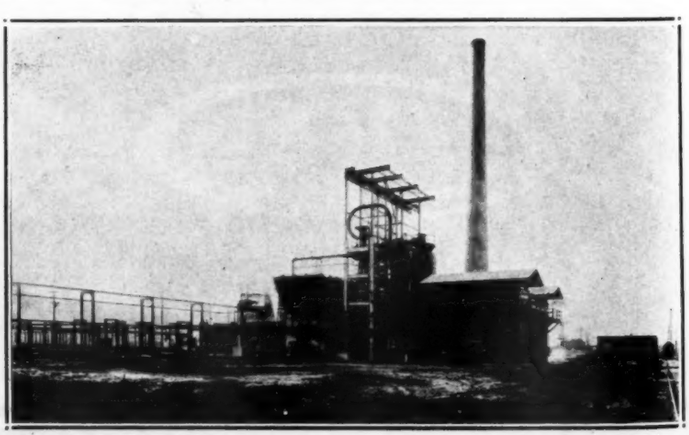
[10]Speller; Corrosion, 163, 1926.

[11]Corrosion, page 509.

[12]Technical Paper No. 177; 18, 1920, United States Bureau of Standards.

VIEWS OF ONE OF THE RECENTLY COMPLETED REFINERIES





Stabilizing unit (left) and vacuum pressure distillate rerun unit at the new refinery of the Gulf Refining Co., Pittsburgh, Pa.

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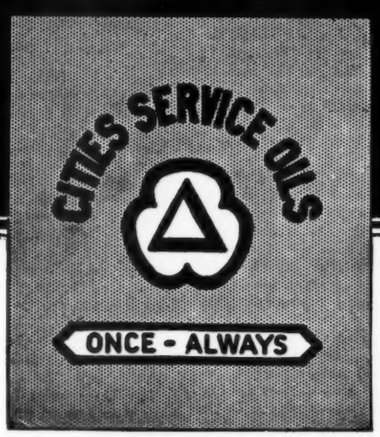

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Subsidiary Cities Service Co.

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KANSAS CITY ST. LOUIS FT. WORTH TORONTO

first place extracts the hydrogen sulphide from the gas, which passes on, then it is necessary to get rid of the sulphur, found in the solution, in addition to the sodium bicarbonate, as sodium acid sulphate. The air decomposes these compounds, as shown in the second equation, and the hydrogen sulphide passes out of the system with the air. According to theory, all of the sodium carbonate may be recovered, but this is not true, for other compounds of sodium are formed, and it is necessary to bring the solution to proper concentration by the addition of sodium carbonate.

The production of sulphur is a modification, or continuation, of the process which has been outlined. It has been known that, with proper conditions, hydrogen sulphide may be decomposed in the presence of sulphur dioxide or oxygen. The reaction is accelerated in the presence of a catalyst. The substance being used for this purpose is colloidal nickel sulphide, made by the addition of nickel sulphide to a solution saturate with sulphur. The fundamental reaction is:

$$2H_2S + O_2 \rightarrow 2H_2O + 2S$$

It is reported that the hydrogen sulphide will yield approximately 85 per cent of its sulphur content in the form of sulphur. The sulphur is produced in the form of a scum on the surface of the liquid from which it is removed by mechanical means. The excess liquid is removed by a filter press. The sulphur is purified by washing with water and drying.

The Koppers process was described in The Oil and Gas Journal, December 2, 1926, page 186, by W. J. Klaiber.

Washing

The washing of gasoline, naphtha, kerosene, and other distillates with caustic soda in the treating operation is largely for the purpose of removing hydrogen sulphide. The essential equations are:

$$2\,NaOH + H_2S \rightarrow Na_2S + 2\,H_2O$$

$$NaOH + H_2S \rightarrow NaHS + H_2O$$

$$Na_2S + H_2S \rightarrow 2\,NaHS$$

In the presence of an excess of the sodium hydroxide sodium sulphide will be formed, but if there is not enough present the sodium acid sulphide will be produced. A similar result will follow as the reaction nears completion, after the formation of the sulphide, when there is an excess of hydrogen sulphide. The volume and concentration of the caustic soda solution should be adjusted and controlled so that there will be the maximum safe production of sodium acid sulphide.

It is essential that all of the hydrogen sulphide be removed, especially from the heavier distillates, before the application of sulphuric acid. If this is not done some free sulphur will be liberated to be dissolved in the product.

$$H_2S + H_2SO_4 \rightarrow S + 2\,H_2O + SO_2$$

Some operators have endeavored to dry the distillate before sweetening by applying an acid wash ahead of the alkali. This is not good practice for the reasons indicated.

Concerning hydrogen sulphide removal from crude oil, Fowler states[12] that it seems surprising that no use appears to have been made of the long known and very simple reaction for recovering elementary sulphur from hydrogen sulphide by its interaction with sulphur dioxide as expressed in the following equation:

$$2H_2S + SO_2 \rightarrow 3S + 2H_2O$$

Sulphur Dioxide

Sulphur dioxide in liquid form is a refining agent in the industry, as exemplified in the Edeleanu process for refining petroleum distillates. While the reaction can be carried out quite well with liquid sulphur dioxide, it may be perhaps more conveniently applied with gaseous sulphur dioxide. Quoting Mr. Fowler:

"If crude oil containing hydrogen sulphide were treated with this gas, as it comes from the well, it would seem, theoretically, that the above reaction must take place, converting the two sulphur compounds into elementary sulphur in solid form and water. Theoretically, also, the oil after this treatment would be perfectly innocuous without any smell due to sulphuretted hydrogen, and be also noncorrosive.

"Moreover, the treatment of large quantities of oil in this way would yield a sulphur product of market value which possibly would more than pay for the simple treatment. The term 'theoretical' is used in the above expressions because the writer has had no opportunity of testing the method on an oil highly charged with hydrogen sulphide.

"The same reaction should be effective in freeing hydrocarbon gases of hydrogen sulphide. It seems to be merely a matter of mixing sulphur dioxide in practically equivalent quantity to bring about the reaction and thus to easily purify the gas, at the same time winning the sulphur as a by-product."

Warning Odor

Any gas which is intended for domestic use should be almost free from hydrogen sulphide because of its toxic properties. It is considered a dangerous poison and very small quantities in a gas have been known to produce fatal results. Irritation and inflammation have resulted from breathing as little as 0.005 per cent and a concentration of 0.06 is considered high and dangerous. When manufacturing gas traces of hydrogen sulphide are frequently permitted to remain because of the odor it imparts to the gas and thus serves to give notice of a leak that otherwise might not be detected.

The quantity of hydrogen sulphide that may be permitted in a domestic gas is regulated by local and state laws. Several city governments have adopted 30 grains per 100 cubic feet for manufactured gas, or about 0.05 per cent by volume. There is no reason why these same limits should not be applied to natural gas. The New York State Commission prescribes that gas shall show no hydrogen sulphide by the lead acetate paper test.

[12]Bureau of Mines Cir. 3,847. Prevention of Hydrogen Sulphide Poisoning in Handling and Refining High-Sulphur Petroleums. 1927.

KENTUCKY-TENNESSEE

(Continued from Page 68)

Brown farm, 1 mile south of the town of Depoy, is reported a dry hole.

In McLean County, Johnson Oil & Refining Co.'s No. 1 on the William C. Howard farm, an offset to the well on the Olive Shockley farm, is said to be good for 5 bbls. at 1,185 feet. Pampas Oil & Gas Co.'s No. 1 D. C. Stephens farm, same county, was a dry hole at 1,180 feet.

In Hancock County, Pellville Field, Hupp & Duff's No. 1 Claud Bolling farm, is a 25-bbl. initial producer, with No. 2 drilling. Same firm struck a 50-bbl. producer in No. 3 on the Bill Bates farm at 355 feet. Kentucky Natural Gas Co.'s No. 1 H. H. Hendricks farm produced but 6 bbls. in 24 hours. This well was drilled for gas.

In the Utica Field of Daviess County, E. L. Newton and others found a duster on the John Trunnell farm.

In the northern part of Barren County and in the Legrande Pool, Norris & Davis struck a nice gas well in No. 1 Doc Wilcoxson farm. Garvin Oil & Gas Co. is drilling No. 1 on the Edwards estate 9-acre tract, same county.

SULPHUR COMPOUNDS FOUND IN LIGHT OILS

(Continued from Page 148)

and are insoluble in water or caustic alkali solutions. On oxidation they form, first, the corresponding sulphoxides R-S=O and, second, the corresponding R /

R O

sulphones >S< . They form addition

R O

products with the halogens-mercuric chloride, and alkyl iodides, and are more or less soluble in sulphuric acid. Doctor solutions hypochlorite and copper oxide seems to have no effect upon them at ordinary temperatures.

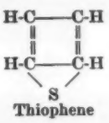
The sulphoxides and sulphones formed from the alkyl sulphides are odorless and neutral compounds, the former being easily oxidized to the latter. The sulphones are very stable toward most oxidizing agents and are not attacked by them.

Sulphonic Acids

The sulphonic acids are compounds in which one hydroxyl (OH) radical of sulphuric acid is replaced by an alkyl radical R. They are formed from mercaptans by oxidation, i.e., R-S-H + 3O = R-S-O_3 — H. They are isomeric with the alkyl sulphites but are not esters and not hydrolized. Unlike the sulphones, the sulphonic acids are soluble in water and acids, and are acid, or faintly acid, in reaction. Alkali washes following treatment with acid removes remaining sulphonic acids as metallic sulphonates. They form nitrates with nitric acid and amines with ammonia.

Thiophenes

The thiophenes are undesirable sulphur compounds found in kerosene and naphtha stocks and are represented in a cyclic or closed series of hydrocarbons. An example of their structure is shown:



Thiophene

The thiophenes are not affected by treatment with doctor solution, or doctor solution and sulphur, copper oxide or sodium hypochlorite at ordinary temperatures. Aluminum chloride is known to decompose some of them on heating. Thiophene has a faint odor, and is insoluble in water. It reacts violently with nitric acid but the use of this reagent colors the oil. Its solution in pure benzene added to a solution of isatin in concentrated sulphuric acid and containing a trace of $FeCl_3$ upon shaking will give an intense blue color. (This is called the indophenin reaction.) Most of the lower members of the series are easily removed with sulphuric acid forming their respective soluble sulphonic acids. Examples:

$C_4H_4S + H_2SO_4 = SO_3HC_4H_3S + H_2O$
Thiophene — Thiophene sulphonic acid

$C_4H(CH_3)_2S + H_2SO_4$
Trimethyl thiophene
$= C_4SO_3H(CH_3)_2S + H_2O$
Trimethyl thiophene sulphonic acid

Free Sulphur

The free sulphur content of an oil can be removed in part or lowered by adding to the oil containing it equivalent quantities in molar concentration of lower mercaptans or mercaptan sulphur. Washing with concentrated aqueous sodium sulphide solution is said to remove free sulphur. With oxygen sulphur forms several different compounds, such as dithionous and dithionic acids as well as sulphuric, sulphurous tri-tetra and pentathionic acids. Sulphur unites with Cl in two proportions forming a chloride and a di-chloride.

INTERMOUNTAIN MEN ORGANIZE

The Intermountain Petroleum Association was formed at a recent meeting of independent oil producers of the intermountain region in the offices of the General Petroleum Corp. of Utah in Salt Lake City. F. E. Settle was chosen executive secretary, and direction of the new organization was vested in a board of governors of 15 members. The association plans to co-operate with similar bodies in other states for the general benefit of the oil industry.

B. F. WILSON DIES

BOWLING GREEN, Ky., Mar. 2.—B. F. Wilson, 50, well known oil operator, died suddenly of a heart attack at his home in this city. He had been to his holdings in Hart County Monday and returned home apparently feeling well. Mr. Wilson was a native of Pennsboro, W. Va., and had been engaged in the oil business practically all his life. He had resided in Bowling Green for 12 years and was well known in the Kentucky fields.

GASOLINE YIELDS FROM OKLAHOMA CITY CRUDE

(Continued from Page 88)

per cent straightrun and 54.6 per cent cracked gasoline. The blended product distilled as follows:

REFINED STRAIGHTRUN AND CRACKED GASOLINES
(A.S.T.M. 100 cc. distillation)

A.P.I. gravity	56.3°
Initial boiling point-endpoint °F.	..127°-436°

Per cent distilled over	Temp. °F.
5	161
10	181
20	210
30	234
40	259
50	281
60	312
70	336
80	360
90	399
95	424
Endpoint	436
Per cent distilled over	97
Bottoms, per cent	2
Loss, per cent	1

Summary of Yields

The yields of gasoline, both straightrun and cracked, pressure distillate bottoms (furnace or Diesel oil), gas, coke and loss, based on the Oklahoma crude oil, are tabulated as follows:

YIELD OF PRODUCTS
(Per cent)
(Based on Oklahoma City Crude Oil)

Grades of gasoline—	400°F. endpoint	437°F. endpoint
Straightrun gasoline	29.4	34.4
Cracked gasoline	40.3	41.4
Total gasoline, per cent	69.7	75.8
Pressure distillate bottoms (Furnace or Diesel oil)	11.9	7.1
Gas, coke and loss	18.4	17.1

SOLONS DROP RESTRICTIVE BILL

The Massachusetts House of Representatives has rejected a bill which would have restricted locations of bulk petroleum distributing plants in the State.

The proposed measure would have prohibited the establishment of tanks or plants, having aggregate capacity of 50,000,000 gallons or over, at any point within 3 miles of the center of population of any city or town in Massachusetts.

The measure was in response to a number of petitions for the establishment of a large bulk terminal alongside the deep water of Chelsea Creek in East Boston.

Although there was considerable pressure to move the bill for action, the legislative committee rejected the measure on the ground that local and state officials already have sufficient authority to act in proposals of the sort.

AMOS J. MITCHELL DEAD

Amos J. Mitchell, vice president of the M. & V. Tank Co., Wichita Falls, Tex., met death recently in an automobile accident near Houston, Tex. Mr. Mitchell was a son of R. Y. Mitchell, of Findlay, Ohio, an oil operator in the early Bradford and Ohio fields. At the time of the Burkburnett excitement he went to Texas and with Frank E. Van Wormer formed the M. & V. Tank Co. For 40 years Mr. Mitchell was engaged in some branch of the oil and gas well supply business in Ohio, Indiana, Oklahoma, Wyoming and Texas. He was an independent oil producer in the Young and Archer County fields. Mr. Mitchell, who was unmarried, leaves two brothers, Frank A. Mitchell, Independence, Kans., and Donald R. Mitchell, Detroit, Mich., and two sisters, Miss Fannie Mitchell, Findlay, Ohio, and Mrs. E. G. Palmer, Shreveport, La.

M. W. PORTER RESIGNS

BOWLING GREEN, Ky., Feb. 28.—M. W. Porter, cashier of the Illinois Pipe Line Co. and one of the initial directors, will retire from active service and leave with his family for the South early in March. Mr. Porter has been in the Kentucky fields with headquarters at Bowling Green since the Illinois Pipe Line Co. entered the western Kentucky area. He has been with the Standard Oil Co. of New Jersey subsidiaries in an official capacity for many years.

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ABSORPTION PLANTS—STABILIZING PLANTS—FRACTIONATORS

WILDCAT OPERATIONS IN KANSAS

(Continued from Page 51)

LYONS COUNTY

Griffith et al's No. 1 King, NW cor. Sec. 8-19-10 .....Shut down 910 ft.

MARION COUNTY

Midwell's No. 1 La Master, NW cor. Sec. 31-22-4 .....Shut down 650 ft.

McPHERSON COUNTY

Henderson & Holden's No. 1 Sommerfield, NE NW Sec. 23-19-1w .....Drlg. 2,954 ft.; showing 25 bbls. of oil and 50 bbls. of water a day; T. D. 3,227 ft.; shut down.

Aladdin Pet.'s No. 1 Rudolph, NW NE Sec. 36-18-3w.....Rig; anbandoned.
Slick et al's No. 1 Randall, C SW SW Sec. 35-17-3w.....Drlg. 3,558 ft.
Aladdin Pet. Co.'s No. 1 Larson, C NW Sec. 23-18-4w.....Rig; anbandoned.

MORTON COUNTY

Hydraulic Oil Co.'s No. 1 State Land, NW SE Sec. 32-34-43w .....Fishing 5-in. csg. 3,460 ft.

MORRIS COUNTY

Great Basin Oil Co.'s No. 1 Ballyntine, SW SE SE Sec. 18-16-5 .....Shut down 2,170 ft.
Urschel et al's No. 1 Bersuch, NW SE NW Sec. 10-17-7..Machine.
Hankerson et al's No. 1 Cessman, SW SE Sec. 24-16-9....Shut down 900 ft.

NESS COUNTY

Gypsy Oil Co.'s No. 1 Coleman, C SW NE Sec. 25-17-25w..Drlg. 4,103 ft.

NORTON COUNTY

Richards et al's No. 1 Colby, Sec. 17-4-21w .....Rig.

OSAGE COUNTY

Briggs & Smith's No. 1 Wood, SE NW Sec. 21-14-15 ....Shut down 1,050 ft.

RAWLINS COUNTY

J. G. Durham et al's No. 1 Unknown, SW cor. Sec. 3-2-35w .....Underreaming 10-in. csg.; T. D. 2,265 ft.

RICE COUNTY

Detrick & Langston's No. 1 Purcell, NW cor. Sec. 33-19-9w .....Rig.
McFadden and Shell's No. 1 Jennings, SW NE NW Sec. 29-18-6w .....Drlg. 400 ft.
Cress et al's No. 1 Sharp, SE NE Sec. 13-20-10w .....Drlg. 1,920 ft.
Allison-Fitzwilliams' No. 1 Blake, NE NW Sec. 9-18-10w..Rig.
Muth Bros.' No. 1 Beyers, NE NW Sec. 21-19-9w .....Silicious lime 3,213-44 ft.; swabbed 134 bbls. 8½ hrs.

ROOKS COUNTY

Empire Oil & Ref. Co.'s No. 1 Halsman, SW NE SE Sec. 17-7-20w .....Shut down 1,325 ft.

RUSH COUNTY

Dewey & Mitchell's No. 1 Greenawalt, C SW Sec. 17-19-16w .....Drlg. 690 ft.

RUSSELL COUNTY

Agate Oil & Gas Co.'s No. 1 Rochfellow, SE cor. Sec. 6-13-12w .....Show oil 3,042-44 ft.; bailed 18 bbls. 3 hrs.; now shut down.

Gilbreath et al's No. 1 Bratton, C NE Sec. 33-11-13w ....Shut down 2,814 ft.

SEDGWICK COUNTY

Streeter & Stearns' No. 1 Tobin, SW SE NE Sec. 5-22-2..Drlg. 3,165 ft.
Buck et al's No. 1 McNananan, NE NW NW Sec. 2-29-1..Shut down 1,200 ft.

SALINE COUNTY

Sampson et al's No. 1 Sudenderf, NE SE Sec. 30-14-2w...Drlg. 3,265 ft.
Twin Mounds Oil Co.'s No. 1 Weis, C W half NE NW Sec. 20-12-4w .....Shut down 2,700 ft.

STEVENS COUNTY

Sidwell et al's No. 1 Kelly, SW NE Sec. 16-34-38w .....Shut down 2,165 ft.

WASHINGTON COUNTY

Sincox et al's No. 1 Penwell, NW SE NE Sec. 16-3-3 ....Shut down 1,720 ft.

WILDCAT OPERATIONS IN OKLAHOMA

(Continued from Page 50)

HASKELL COUNTY

Ault et al's No. 1 Harrison, CWL SE NE Sec. 14-9-19 ....Shut down 650 ft.
Ault et al's No. 1 Hall, NW SW SW Sec. 14-9-19 .....Shut down 2,000 ft.
Ault et al's No. 1 Hall, SE NW Sec. 25-9-19 .....Shut down 50 ft.
I. T. I. O.'s No. 1 Blake, SW NW Sec. 3-10-21 .....Shut down 3,007 ft.; abandoned.
Mid-Western's No. 1 Polster, C NE SE Sec. 33-10-22 ....Shut down 4,297 ft.; abandoned.

HUGHES COUNTY

Wright et al's No. 1 Ott, SE SW Sec. 16-5-11 .....Shut down 1,645 ft.

KAY COUNTY

Wilwright Gas Co.'s No. 1 Wildegrube, NE SW Sec. 14-27-1 ..... Drlg. 3,730 ft.
Lewis et al's No. 1 Harris, SE NW Sec. 14-25-1 .....Location.
Peters & Buckles' No. 1 Hayes, NW NE NW Sec. 24-28-3 .....Drlg. 2,600 ft.
Mummert Drlg. Co. et al's No. 1 Cormick, C NW SE Sec. 9-27-2 .....Shut down 2,700 ft.
Blackwell Oil & Gas Co.'s No. 1 Harshman, Sec. 2-26-1w.Rig on ground.
Boucher Oil Co.'s No. 1 Jefferson, NE SW Sec. 32-26-1w..Drlg. 2,976 ft.

KIOWA COUNTY

Christian's No. 1 Jones, NE SE Sec. 8-7-18w .....Rig.

LATIMER COUNTY

Choctaw Gas' No. 1 Weaver, C NE NW Sec. 4-6-18 .....Rig.
P. English's No. 1 Unknown, NW SE Sec. 16-6-19 .....Shut down 300 ft.
Leflore Oil Co.'s No. 1 McBee, NW cor. Sec. 3-7-21 .....Shut down 3,601 ft.

LE FLORE COUNTY

D. S. Howard et al's No. 1 Holmes, SE SW NW Sec. 16-3-22 .....Shut down 800 ft.

LINCOLN COUNTY

Mote-Wheeler's No. 1 Stafford, NW NE Sec. 32-17-4 ....Drlg. 3,210 ft.

LOGAN COUNTY

Eason Oil Co.'s No. 1 Young, C SW NE SW Sec. 34-17-4w..Sand 4,919-42 ft.; made 870 bbls 21 hrs. and 485 bbls. the second 24 hrs.

McINTOSH COUNTY

Patterson et al's No. 1 Smith, SW cor. NW SE Sec. 32-9-16 .....Fishing 5,687 ft.

MUSKOGEE COUNTY

Rebold's No. 1 Miller, SE NE NE Sec. 32-13-19 .....Rig.
Sioux Oil Co.'s No. 1 Unknown, NW SE Sec. 21-11-19 ....Shut down 1,011 ft.

OKFUSKEE COUNTY

Henry Oil Co.'s No. 1 Harjo, Sec. 36-12-9 .....Shut down 4,127-57 ft.; water. plugged back to 3,161-85 ft. showing 10 bbls.

E. L. Robinson's No. 1 Rice, NW Sec. 2-10-9 .....Location.
Shepard et al's No. 1 Neveas, SE NW SW Sec. 3-12-10....Shut down 3,690 ft.

OKLAHOMA COUNTY

Citizens Oil Co.'s No. 1 Sage-Barber, NE cor. Sec. 21-11-3w .....Shut down 1,200 ft.
L. C. Hivick's No. 1 Sunset Addition, NW SW NW Sec. 17-11-3w .....Shut down 5,515 ft.
J. F. Cuniff, trustee's No. 1 Church Land, NE SW SE Sec. 17-12-4w .....Shut down 6,700 ft.

PAWNEE COUNTY

Rookstool's No. 1 Wylie, NW NE SW Sec. 6-20-5 .....Shut down 1,950 ft.
Sperry et al's No. 1 Mullrap, SE SW Sec. 2-22-5 .....Shut down 1,740 ft.
Cochran et al's No. 1 Green, NE cor. SW, Sec. 15-23-5....Rig.

PITTSBURG COUNTY

J. Morrison's No. 1 Fowler, NE SE Sec. 13-7-17 .....Rig.
C. Kennedy's No. 1 Travis, C SW NE Sec. 15-7-14 .....Rig.
C. Canady's No. 1 Jones, NW cor. Sec. 14-8-14 .....Rig.

POTTAWATOMIE COUNTY

J. E. Crosbie et al's No. 1 Brown, NE NW SW Sec. 2-9-4 .....Drlg. 3,490 ft.

ROGER MILLS COUNTY

Ute Oil Co.'s No. 1 Williams, C SW Sec. 23-12-24w .....Rigging up standard tools 2,348 ft
L. C. Hivick's No. 1 Davis, C NW NE Sec. 4-11-26w ....Shut down 2,905 ft.

SEMINOLE COUNTY

Sunray Oil Co.'s No. 1 Sunday, NW SE Sec. 35-5-5 .....Location.

STEPHENS COUNTY

Junior Oil Co.'s No. 1 Thompson, CNL SE SE Sec. 1-1-7w .....Shut down 3,329 ft.
Ross Southard's No. 1 McKinney, NE cor. Sec. 25-1-8w...Shut down 1,063 ft.

WASHITA COUNTY

Cooper & Terhune's No. 1 Blocker, NW cor. Sec. 29-8-19w. Drlg. 1,447 ft.
Burns & Prince's No. 1 Deck, SW cor. Sec. 21-8-18 .....Shut down 100 ft.
Petroleum Holdings, Inc.'s No. 1 Musie, NW cor. Sec. 10-9-20w .....Shut down 280 ft.

WOODWARD COUNTY

Prairie Oil & Gas Co. et al's No. 1 Wilbur, NE cor. NW Sec. 22-23-17w .....Shut down 7,445 ft.

OKLAHOMA PANHANDLE

TEXAS COUNTY

Three Way Oil Co.'s No. 1 Crane, SW NW Sec. 11-1-1S .....Shut down 4,425 ft.
Palo Alto Oil Co.'s No. 1 Graves, NE SW SW Sec. 23-2-1Se .....Spudded; shut down.

SOUTHERN OKLAHOMA

ATOKA COUNTY

Stewart-Howland's No. 1 Howard, NW SE NW Sec. 6-4s-11 .....Shut down 100 ft.
Brookshire's No. 1 R. W. Rowland, NW NE SE Sec. 18-3s-10 .....Shut down 400 ft.

BRYAN COUNTY

Bryan County Oil's No. 1 Childs, NW SE SW Sec. 7-7-10.T. D. 650 ft.
Bush et al's No. 1 Commerce Trust, NE cor. Sec. 35-6s-9 .....Shut down 690 ft.
Johnson et al's No. 1 Ussery, SE SW SE Sec. 14-16s-7e...Shut down 485 ft.

CARTER COUNTY

Campen-Lasater Co.'s No. 1 Anderson, NE cor. SE NE SE Sec. 32-4s-2 .....Shut down 2,806 ft.

COTTON COUNTY

Gilbert-Lowery's No. 1 Harneg, C SE SE Sec. 4-2S-11w...Drlg. 1,900 ft.

JEFFERSON COUNTY

Smith's No. 1 M. O. Carty, SE NW NE Sec. 18-4s-8w ....Location.

LOVE COUNTY

Batson & Sterrette's No. 1 Dillard, SE NE NW Sec. 25-6s-3 .....Show 5 bbls. 1,585-96 ft.
Hobbs et al's No. 1 Roberts, NE cor. SW Sec. 20-6s-3w...Shut down 3,130 ft.

MARSHALL COUNTY

D. H. Curry's No. 1 Ward, NE SE SW Sec. 15-5s-6 .....Drlg. 1,396 ft.
McCrory et al's No. 1 Adams, NE SW SE Sec. 31-7s-6 ....Show 10 bbls. 532-40 ft.; 12 hrs.

STEPHENS COUNTY

Andrea et al's No. 1 Patrick, C E half SE Sec. 3-3s-8w.. Shut down 1,853 ft.
Obermyer et al's No. 1 Skelton, NE SW SW Sec. 32-15-7w .....Shut down 1,375 ft.

WILDCAT OPERATIONS IN LOUISIANA-ARKANSAS

(Continued from Page 54)

Joe Marr et al's No. 1 Maxwell, C, Sec. 35-3n-8e.....S.D. 3,622 ft.
United Gas Public Service Corp.'s No. 3 Saunders, 2,497 ft. E, 3,883 ft. S, NE cor., Sec. 11-8-9, in Sec. 42..Drlg. 881 ft.
Fred Stovall's No. 1 Grasmere (no check), Sec. 23-8-10. Drlg. lime 830 ft.

DE SOTO PARISH

Dupree-Fountain's No. 1 J. M. Nabors, 250 ft. S, 250 ft. W, NE cor. NW, Sec. 5-13-11.....Rig up.
S. A. Guy's No. 1 Dowling Bros., 469 ft. E, 382 ft. S, NW cor. NE, Sec. 31-14-14.....S.D; sandy shale 1,354 ft.
Keatchie O. & G. Co.'s No. 1 Hallie Smith (was H. E. Weichert's), NE SE, Sec. 31-14-15.....S.D. 2,350 ft.
C. D. Neff et al's No. 1 Ramsey, 1,000 ft. W, 400 ft. S, NE cor. SE, Sec. 33-13-16.....Coring sand 2,107 ft; corrected depth.
Ernest Nickelson's No. 1 Nabors, 1,200 ft. N, 1,800 ft. W, SE cor., Sec. 32-13-11.....Drlg. 1,290 ft.

NATCHITOCHES PARISH

W. M. Coats' No. 1 Collins, 730 ft. N, 50 ft. E, C, Sec. 28-9-10 .....S.D. 3,718 ft.
J. W. Cooper et al's No. 1 Cooper, NW SW, Sec. 35-11-10 .W.O. 2,908 ft.
Cooper et al's No. 2-A Cooper, C SE SE, Sec. 32-11-10. S.D. 1,518 ft.
Gulf Ref. Co.'s No. 1 Bodcaw, 1,910 ft. S, 605 ft. W, NE cor., Sec. 13-13-8.....Drlg. shale and lime 3,727 ft.
C. M. Talley et al's No. 1 C. M. Talley, 1,980 ft. W, 660 ft. S, NE cor. SE, Sec. 29-11-10.....Drlg. 1,250 ft.

RED RIVER PARISH

La. Oil & Dev. Co.'s No. 2 La. Delta Pecan Co., 2,950 ft. S, 300 ft. E, NW cor., Sec. 27-13-11.....Location.
Lucky Strike Oil Co.'s No. 1 Chaffraix, 200 ft. S, 200 ft. E, C, Sec. 32-12-10.....S.D. 3,010 ft.

RICHLAND PARISH

Alto Gas Co.'s No. 2 Hunt, 660 ft. S and E, NW cor., Sec. 13-17-5 .....Derrick.
Southern Carbon Co.'s No. 1 C. M. Noble, 4,636 ft. N, 2,254 ft. W, cor. Secs. 7, 8, 17 and 18, in Sec. 37-15-6..Drlg. 1,730 ft.
Southern Carbon Co.'s No. 1-B C. M. Noble, 2,966 ft. N, 1,525 ft. W, cor. Secs. 7, 8, 17 and 18, in Sec. 37-15-6..Location.

SABINE PARISH

Buttram O. & G. Co.'s No. 1 Hale, 200 ft. N, 200 ft. E, SW cor. NE NE, Sec. 1-7-13.....Top chalk and cmtd. 6⅝-in. 2,068 ft.
Durham Oil Co.'s No. 1 Polly (was Davis et al's), NE cor. NE NE, Sec. 18-8-12 (was Stacy et al's).....Cmtd. 8¼-in. 2,086 ft.
Diffie & Barnett's No. 1 Lites (was J. W. Clark's), 330 ft. N, 330 ft. W, SE cor. SW NW, Sec. 34-8-11..S.D. 105 ft.
Franks et al's No. 1 Dew, 200 ft. N, 300 ft. E, SW cor. SE, Sec. 22-8-11.....Fishing bailer 2,380 ft.
Lacey Jessup Oil Co.'s No. 1 Brown Lbr. Co. (was Lacey et al's), C NW NE, Sec. 28-8-10.....S.D. 3,160 ft.
Lacey Prod. Co.'s No. 1 Cooper, 330 ft. N, 330 ft. W, SE cor. SW NW, Sec. 30-8-11.....W.O.S.R; 1,200 ft. oil; T.D. 2,620 ft.
Lawrence et al's No. 1 Hubley, 330 ft. N, 330 ft. W, SE cor. NE, Sec. 21-7-11.....S.D. 2,650 ft.
Lide et al's No. 1 Ponder, 990 ft. N, 990 ft. W, C, Sec. 15-7-11 .....W.O.S.R. 2,800 ft.
Lide et al's No. 2 Ponder, 200 ft. S, 200 ft. E, NW cor. NE NW, Sec. 15-7-11 .....Arranging to deepen 2,520 ft.
Magnolia Pet. Co.'s No. 1 R. J. Lucius, 990 ft. S, 990 ft. W, NE cor. NW NE, Sec. 2-5-12.....Drlg. lime 3,948 ft.
Merritt et al's No. 1 Byrd, 200 ft. N, 200 ft. W, SE cor. NW, Sec. 1-7-11.....Drlg. 1,500 ft.
P. & G. Oil Co.'s No. 1 Williams, 330 ft. S, 330 ft. W, NE cor. SE NW, Sec. 21-7-12.....Rig up.
Packard O. & G. Co.'s No. 1 Smith (was Caddo-Sabine Synd.'s), Sec. 8-7-10.....Drlg. 1,650 ft.
W. P. Pearce et al's No. 1 G. Pearce, 330 ft. N, 330 ft. W, SE cor. SW NW, Sec. 10-7-11.....W.O; 150 ft. oil in hole; T.D. 2,600 ft.
D. H. Riddick's No. 1 Scretchfield, 400 ft. E, 400 ft. N, SW cor. NW SE, Sec. 18-9-12.....S.D. 3,310 ft.
Trans-America Oil Corp.'s (was Southland Oil Co.'s), No. 1 Carter, 1,030 ft. W, 345 ft. N, SE cor. SE NE, Sec. 36-8-12.....W.O; 60 ft. oil in hole; T.D. 2,513 ft.
Wilson & Son's No. 1 Gandy-Garrett, NW SW, Sec. 4-5-12 (portable rig) .....T.A. 2,509 ft.
John Woodley's No. 1 Sabine Lbr. Co., 400 ft. S, 330 ft. W, NE cor. SE, Sec. 12-8-12.....Coring 2,049 ft.

TENSAS PARISH

Seip et al's No. 1 Fowler, C SW NE, Sec. 10-10-10....S.D. 905 ft.
A. R. Willis et al's No. 1 Currey, 1,320 ft. S, 1,320 ft. E, NW cor., Sec. 39-11-12.....Drlg. 3,148 ft.

WEBSTER PARISH

Coyle, tr.'s No. 1 Frazer, 200 ft. N, 200 ft. E, SW cor. NE SE, Sec. 27-23-11.....Derrick.
Red Hawk Oil Co.'s No. 1 Mathews, 330 ft. N, 330 ft. E, C, Sec. 11-23-9.....S.D. 250 ft.

ARKANSAS

CHICOT COUNTY

R. R. Smith's No. 1 Lytle, 660 ft. N, 660 ft. E, C, Sec. 31-18-3.....Cmtd. back to 2,888 ft; T.D. 2,925 ft; arranging whipstock 2,865 ft.

CLAY COUNTY

S. C. Jeffus' No. 1 Underwood, 510 ft. N, 350 ft. W, C NW SE, Sec. 4-20-8.....S.D. 805 ft.

CLEBURNE COUNTY
(Cable tools)

Donnelly-Craver et al's No. 1 Donophan Lbr. Co., SE cor. NW, Sec. 33-11-9.....S.D. 3,740 ft.

CRAWFORD COUNTY

Citizens Gas Co.'s No. 1 G. W. Hood, 600 ft. S, 300 ft. E, NW cor. NE SE, Sec. 13-9-32.....Location.

DALLAS COUNTY

E. C. Brewer's No. 1 W. E. Hillman, 30 ft. E, 40 ft. S, NW cor. SE NE, Sec. 20-10-13.....Drlg. lime and sand 2,642 ft.
J. H. James, tr.'s No. 1 Fordyce Lbr. Co., 200 ft. S, 200 ft. E, NW cor. NW NE, Sec. 11-9-15.....Arranging D.S. test 1,975 ft.

GARLAND COUNTY
(Cable tools)

Givens et al's No. 1 Garrett, 660 ft. S, 660 ft. W, C Sec. 1-8-19.....Fishing 5 3/16-in.; T.D. 3,756 ft.

GRANT COUNTY

Spann & McClung's No. 1 Sarah Page, 660 ft. W, 660 ft. S, NE cor. NW, Sec. 3-3-12.....S.D. for csg. 438 ft.

HOT SPRINGS COUNTY

Anisman et al's No. 1 Hinson est., NE NE, Sec. 19-4-16 (portable rig).....S.D; W.O. 1,604 ft.
John Watkins' No. 1 Cunningham (was J. R. Lockhart's), 285 ft. S, 285 ft. W, NE cor., Sec. 11-5-16...S.D. 100 ft.

LAFAYETTE COUNTY

McIver et al's No. 1 Hottle, NW cor. NE, Sec. 1-20-6....S.D. for fuel 2,345 ft.
Smitherman & McDonald's No. 1 Reed, 200 ft. N, 200 ft. W, SE cor. NW NW, Sec. 16-15-22.....Cmtd. 8-in. 1,192 ft; T.D. 1,194 ft.

LITTLE RIVER COUNTY

Roberts Oil Co.'s No. 1 H. J. Russell, 330 ft. E, 330 ft. S, NW cor., Sec. 25-12-29.....Location.

LOGAN COUNTY

J. H. Flowers' No. 1 J. H. White, Sec. 13-6-26.....S.D; W.O. 3,610 ft.

MADISON COUNTY
(Cable tools)

J. W. Baxter's No. 2 Hallin, C, Sec. 17-16-25.....T.A. 405 ft.
J. W. Baxter's No. 3 Hallin, NE SW, Sec. 1-17-26.....S.D. 50 ft.

MILLER COUNTY

Bullock Oil Co.'s No. 1 Hervey, SE NE Sec. 33-14-26 ...D.S. stuck 2,720 ft; T.D. 2,813 ft.
East Texas O. & G. Co.'s No. 1 Harvey, 500 ft. E, 300 ft. S, NW cor., Sec. 2-15-26.....S.D. 2,961 ft.
E. & F. Oil Co.'s No. 1 E. L. Beck, 200 ft. S, 200 ft. E, NW cor. SW, Sec. 36-15-26.....S.D. litigation; T.D. 2,968 ft.
Fitzwater et al's No. 1 Beck, 200 ft. N, 200 ft. W, SE cor. SW SE, Sec. 33-15-26.....Drlg. 150 ft.
Gusher Bend Oil Co.'s No. 1 Adams, 120 ft. S, 600 ft. W, NE cor. NW, Sec. 26-14-26.....Drlg. lime and shale 2,585 ft.
Lenz et al's No. 2 Johnson, SE cor., Sec. 24-15-16 .....S.D. 4,500 ft.
Lenz et al's No. 3 Johnson, 250 ft. W, 150 ft. N, SE cor. NE NW, Sec. 24-15-26.....S.D. 2,850 ft.
J. D. McRae's No. 1 Smith, 150 ft. N, 150 ft. W, SE cor., Sec. 28-15-26.....Derrick.
Salzer & McRae's No. 1 Rose, SW cor. NE SW, Sec. 9-16-26 .....S.D. fuel 475 ft.

OUACHITA COUNTY

Belmont et al's No. 1 Buck, SE cor. SE SW, Sec. 16-15-17 .....S.D. 2,907 ft.
Copenhaven et al's No. 1 Elliott, Sec. 11-15-17.....S.D; W.O. 2,137 ft.

PIKE COUNTY

E. R. Henderson's No. 1 Tilyou, 660 ft. W, 500 ft. S, NE cor. NE SE, Sec. 26-8-14.....Drlg. rock 2,310 ft.
E. R. Henderson's No. 1 J. L. Lee, 400 ft. S, 350 ft. E, NW cor. SW SE, Sec. 31-8-24.....Derrick.

POPE COUNTY

Ark.-La. P. L. Co.'s No. 1 Baird, 760 ft. S, 660 ft. E, NW cor., Sec. 11-7-20.....Drlg. 275 ft.
Ark.-La. P. L. Co.'s No. 2 McFaddin, 685 ft. N, 485 ft. W, SE cor. NE SW, Sec. 15-9-21.....Hole full wtr; S.D. 3,975 ft.

SCOTT COUNTY

Ark. Valley Gas Co.'s No. 1 Turner, C SE, Sec. 27-5-30..Location.
Heavener O. & G. Co.'s No. 1 Riser, Sec. 36-4-26.....S.D. 1,536 ft.
Waldron O. & G. Co.'s No. 1 White, NE cor. SW NW, Sec. 17-3n-29.....Junked and abd; skidded 20 ft. west; T.D. 1,815 ft.

UNION COUNTY

Chapman & Wilson's No. 1 A. H. Hadley, 330 ft. N, 330 ft. E, SW cor. NE SW, Sec. 3-18-13.....Cmtd. 6⅝-in. 3,559 ft.
S. B. Hickman's No. 1 Hogg, 330 ft. S, 150 ft. E, NW cor. SE SE, Sec. 35-16-17.....Drlg. 3,203 ft.
Marine Oil Co.'s No. 2-B Thompson, 330 ft. N, 330 ft. E, SW cor. SE NE, Sec. 10-18-13.....Drlg. 3,100 ft.
C. H. Murphy et al's No. 1 Union Saw Mill Co., 330 ft. E, 330 ft. N, SW cor. NW SW, Sec. 18-18-13.....Began drlg. Feb. 23; drlg. 100 ft.

VAN BUREN COUNTY

Glenn Kohle et al's No. 1 Scalan, 200 ft. S, 200 ft. W, NE cor. SE NW, Sec. 5-19-13.....S.D. 50 ft.

WASHINGTON COUNTY
(Cable tools)

Delbert & Graves' No. 1 Cunningham, Sec. 14-15-32.....S.D; W.O. 602 ft.
C. H. Willoughby's No. 1 Jones, Sec. 34-16-30 .....Drlg. hard rock 1,742 ft.
H. H. Taylor et al's No. 1 Runny, C NE SW, Sec. 1-13-29..S.D. 1,700 ft.

YELL COUNTY
(Cable tools)

Tegmeier & Luckett's No. 1 Falcon, Sec. 36-7-21.....S.D. 5,710 ft.

EAST TEXAS

BOWIE COUNTY

Maud-Redwater Oil Co.'s No. 1 Merritt, 175 ft. N, 175 ft. E, SE cor. G. W. Hardidge 100-ac. tr. on Floyd Merritt tr. in Y. S. McKinney Sur. .....S.D. 632 ft.
Lee Timberlake et al's No. 2 Tidwell, 2,510 ft. N, 655 ft. W, SE cor. T. M. Rice Sur. .....S.D. 720 ft.

CAMP COUNTY

McDonald Bros.' No. 1 Tillery, 150 ft. E, 450 ft. S, NW cor. 127-ac. tr. in J. H. Murphy Sur. .....Cored sand 3,510-20 ft; drlg. 3,600 ft.

CASS COUNTY

Olds & Smith's No. 1 Atheny, 3,056 ft. W-E line, 856 ft. S-N line, J. C. Byers Sur. .....Making D.S. test 1,470 ft.
John C. Rogers' No. 1 I. E. Lanier, 573 ft. N, 879 ft. W, SE cor. Lanier 86 ac. in K. E. Welborn Sur. ....Cmtd. 6⅝-in. 2,275 ft.
John C. Rogers et al's No. 1 W. Q. Henderson, 3,100 ft. S, 3,100 ft. E, NW cor. Wm. Davis. Sur. .....S.D. 810 ft.
J. E. Smitherman's No. 1 Bell, 385 varas S, 108 varas W, NE cor. J. E. Ferrall Sur. .....Drlg. 2,400 ft.

HARRISON COUNTY

Corona Pet. Co.'s No. 1 A. J. Bohler, C, Bohler 140 ac. in SW cor. S. F. Sparks Sur. .....Began drlg. Feb. 20; cmtd. 12½-in. 214 ft; drlg. 900 ft.
Crump & Hannegan's No. 1 Dunn, Betty Humphreys Sur..Began drlg. Feb. 20; cmtd. 12½-in. 270 ft; coring 1,600 ft.
W. M. Hobson, tr.'s No. 1 P. P. Taylor, Hy Vardaman Sur. .....Rig up.
S. D. Hunter's No. 2 Doherty, W. D. Burris Sur. .....Drlg. 3,517 ft.
O. H. Parkening's No. 1 T. J. Taylor, center Blk. 32, W. H. Payne Sur. .....Derrick.
O. H. Parkening's No. 2 T. J. Taylor, center J. C. Hawley Sur. .....Derrick.
W. G. Ray Drlg. Co.'s No. 1 F. C. Hall, D. Davis Sur. ...Began drlg. Feb. 20; cmtd. 10-in. 173 ft; drlg. 1,100 ft.
Rowe-Nichlos' No. 1 Pitts, E. A. Merchant Sur. .....Location.

MARION COUNTY

Geo. Hindman et al's No. 1 F. V. Lindsey, 2,500 ft. S, most northerly N line, 3,555 ft. E most easterly W line, Alexander Albright Sur. .....S.D. repairs 400 ft.
Hindeman & Rhondo's No. 1 McGaughey, 1,547 ft. W, most northerly SW cor., 1,638 ft. N, most northerly S line, W. J. Willis Sur. .....S.D. 2,300 ft.
P. E. Hussey's No. 1 A. A. Trammell, Chas. Lockhart Sur. .....Fishing 10 joints D.S.; T.D. 1,884 ft.
Shasta Oil Co.'s No. 1 B. E. Johnson, approximately 1,500 varas E and 500 varas S of SE cor. E, S. T. Greer Sur. in Wm. Mason Sur. .....Bldg. derrick.

PANOLA COUNTY

Everette Drlg. Co.'s No. 1 E. L. McDaniels, 200 ft. S, 200 ft. W, NE cor. McDaniels' 116 ac., Alanson Barr Sur. .....Derrick pattern.

RED RIVER PARISH

D. M. Buffington's No. 1 Hossler, E. Hughhart Sur. ....S.D. 2,795 ft.
Johnson Pet. Co.'s No. 2 Randolph, Edw. Dean Sur. ...Drlg. rock 2,278 ft.

SHELBY COUNTY

I. M. Bradley's No. 1 Ashberry (no check), G. W. Mitchell Sur. .....Location.
Chapparell Oil Co.'s No. 2 Holt, Matthew Moore Sur. ....S.D. 3,111 ft.
Sloan Prospecting Co.'s No. 1 Sanford, approximately 300 ft. N and 200 ft. E, SW cor. B. Sanford 49-ac. tr. in M. M. Vann Sur. .....Bldg. derrick.

WILDCAT OPERATIONS IN MISSISSIPPI

CLARK COUNTY

Company, farm and location—	Remarks—
Gulf Ref. Co.'s No. 1 Box, 526 ft. W, 498 ft. N, C SE, Sec. 11-2n-15e	Rigging up.

CLAY COUNTY
(Cable tools)

Ohio Oil Co.'s No. 1 Cantrell, NE cor., Sec. 16-15-5..... Fishing for bit; sandy shale 2,920 ft.

COVINGTON COUNTY

United Prod. Co.'s No. 1 McIntosh (was S. P. Borden et al's), 330 ft. S, 330 ft. W, NE cor. SW NE, Sec. 8-8-16 .....Fishing D.S; T.D. 3,378 ft.

GRENADA COUNTY

Carter-Pace's No. 1 Dubard (was F. E. West et al's), NW NW, Sec. 18-22-4 .....S.D. for fuel 3,176 ft.

HINDS COUNTY

Atkisson & Dyer's No. 1 Downing et al, SE NE, Sec. 27-6-1 .....Drlg. 50 ft.
Cane River O. & G. Co.'s No. 1 Kabbles, NE cor. SW SW, Sec. 15-5-1e .....Cmtd. cavity 3,270 ft; in red beds.
Gulf Ref. Co.'s No. 1 McLaurin, 1,230 ft. S, 1,410 ft. W, NE cor., Sec. 30-6-2e .....Drlg. out cmt. 2,630 ft; T.D. 2,646 ft.
Howard Oil Co.'s No. 1 Jackson College, C NW NW, Sec. 9-5-1e .....Drlg. 100 ft.
Miss. Pet. Co.'s No. 1 Solvent Inv. Co., NE cor. NE SW SW, Sec. 14-5-1w .....T.A. 3,042 ft.
Southern Pet. Co.'s No. 1 Wilson (was Tri-State O. & G. Co.'s), 320 ft. E, 240 ft. N, SW cor. SE NE, Sec. 28-6-1e .....S.D. 20 ft.

JASPER COUNTY

Bay Springs Pet. Co.'s No. 1 Keys, C NW NE, Sec. 21-2-10 .....S.D; W.O. 104 ft.

LAFAYETTE COUNTY

Banks-Good et al's No. 1 May, 113½ rds. S, 26 rds. E, NW cor. SW, Sec. 32-10-1w .....Derrick.

MADISON COUNTY

Central O. & G. Co.'s No. 1 Cameron, 200 ft. W, 200 ft. N, SE cor., Sec. 11-9-1e .....Coring 3,000 ft.

MONROE COUNTY

Amory Dev. Co.'s No. 1 Bourland, Sec. 2-13-19.....W.O. 3,007 ft.
Amory Pet. Co.'s No. 1 Harris, SW cor. SE SE, Sec. 13-13-7 .....Drlg. hard sand 1,116 ft.
Park Bowser et al's No. 1 Cowart, second hole, Sec. 2-12-19 .....Drlg. 1,320 ft; sandy lime.

RANKIN COUNTY

R. A. Moore et al's No. 1 Interior Lbr. Co., Sec. 28-6-1e..S.D. 900 ft.
Cleve Love's No. 1 Muse, SE cor. SW SW, Sec. 32-7-4e..Drlg. Wilcox 2,100 ft.
Millstein O. & G. Co.'s No. 1 Gammill-Hartsfield, 400 ft. E, 400 ft. N, SW cor. SW SE, Sec. 6-5-2e .....W.O. 2,503 ft.

SMITH COUNTY

Pocahontas Nat. Gas Co.'s No. 1 Adams-Banks Lbr. Co. C NE SW NW .....Rig up.

WARREN COUNTY

Dixie Pet. Co.'s No. 1 Clark, 300 ft. E, 660 ft. S, NW cor., Sec. 31-17-5 .....Arranging set 8¼-in. csg. 2,191 ft; T.D. 2,248 ft.

WINSTON COUNTY

Miss. Drlg. Co.'s No. 1 Scarbrough, NW cor., Sec. 15-12-14. Drlg. sand 2,356 ft.

YALOBUSHA COUNTY

Collett-Carter Oil Co.'s No. 2 Blackmur, 990 ft. W, 285 ft. N, C, Sec. 14-11-4.....Cmtd. 6⅝-in. 2,426 ft.

LOUISIANA-ARKANSAS PROVEN AREAS

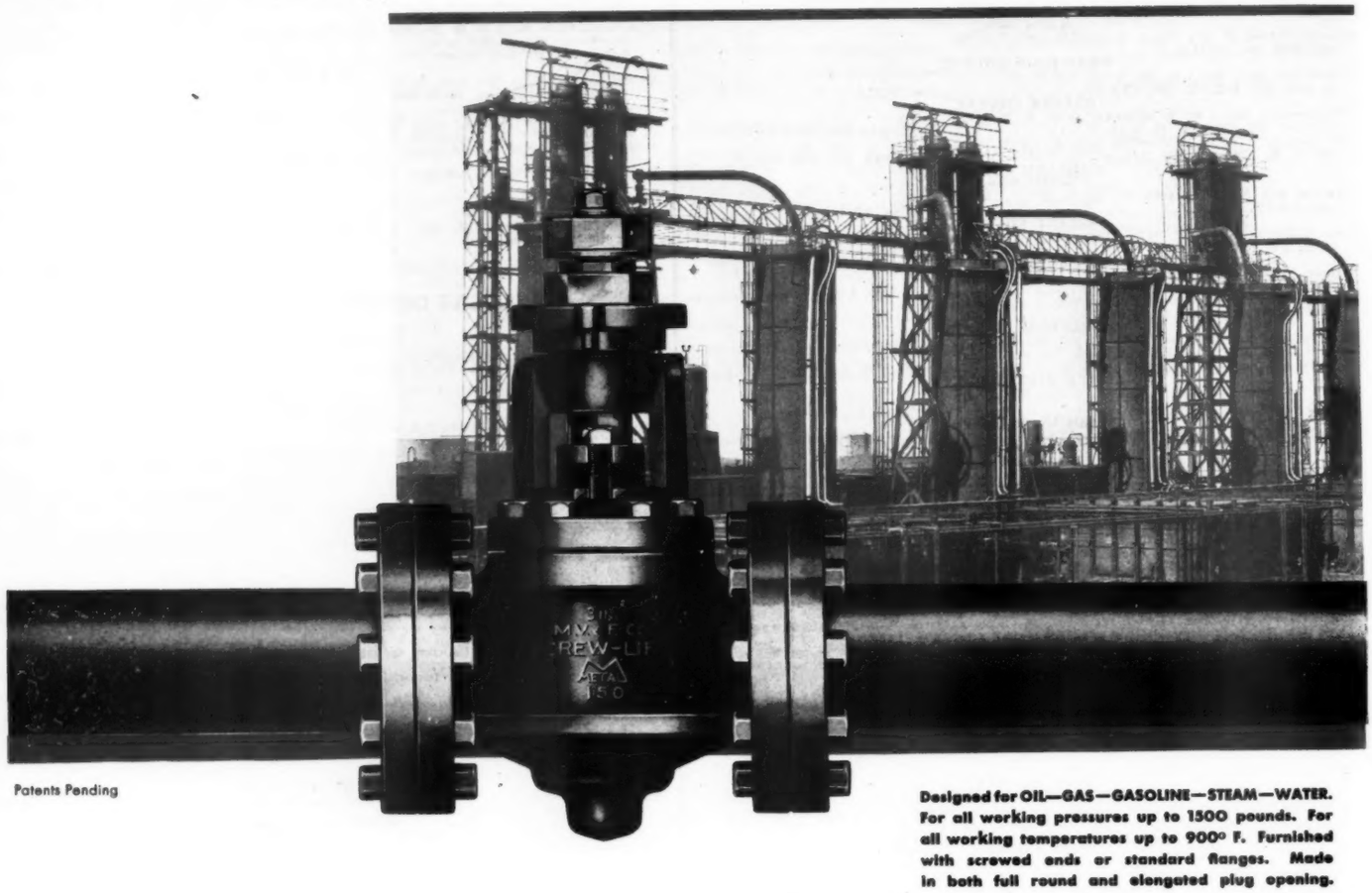
(Continued from Page 54)

Richland Operating Co.'s No. 1 Cooper, 600 ft. N, 600 ft. W, SE cor., Sec. 13-16-6.....Location.
Southern Carbon Co.'s No. 2-B Thomason, 1,980 ft. S, 2,080 ft. W, NE cor., Sec. 23-16-6 .....Drlg. 2,010 ft.
United (was Southern) Carbon Co.'s No. 2 Cooper, 660 ft. N, 3,551 ft. E, SW cor., Sec. 13-16-6.....Location.
United Carbon Co.'s No. 1 Lindow, 1,980 ft. S, 37 ft. E, NW cor., Sec. 15-16-6.....Cmtd. 8-in. 850 ft.
United Prod. Co.'s No. 1-A Wolf, 660 ft. S, 1,650 ft. E, NW cor. SW, Sec. 35-17-6.....Cmtd. 6-in. 2,298 ft.
United Prod. Co.'s No. 1-B Wolf, 1,980 ft. N, C, Sec. 34-17-6 .....Arranging to test 2,450 ft.

SABINE PARISH—ZWOLLE

Bradley Drlg. Co.'s No. 1 Newton, 600 ft. W, 600 ft. S, NE cor. NW SE, Sec. 25-8-12.....Cmtd. 6⅝-in. 2,316 ft.
W. M. Coats' No. 2-A Sabine Lbr. Co., 330 ft. S and E, NW cor. NW SW, Sec. 1-7-12.....Derrick.
O. A. Gautier et al's No. 1 Mischell, 330 ft. E, 150 ft. N, SW cor. SE NW, Sec. 30-8-12.....Fishing D.S. 1,800 ft.
Ab Jones et al's No. 1 Ferguson, 330 ft. N, 330 ft. W, SE cor. NE SW, Sec. 33-8-12.....S.D; W.O. 2,448 ft.
Lacy Prod. Co.'s No. 3 Cooper, NW cor. SW NE, Sec. 30-8-12 .....Location.
Ohio Oil Co.'s No. 6 Bowman-Hicks, 300 ft. N, 265 ft. W, C, Sec. 2-7-12 .....W.O.S.R; 1,800 ft. fluid 2,509 ft.
Ohio Oil Co.'s No. 7 Bowman-Hicks, 250 ft. N, 1,370 ft. E, SW cor. NW NE, Sec. 2-7-12.....Rig up.
H. W. Perritt's No. 2 Bowman-Hicks, NW cor. SE NE, Sec. 2-7-12 .....S.D; W.O. 2,275 ft.

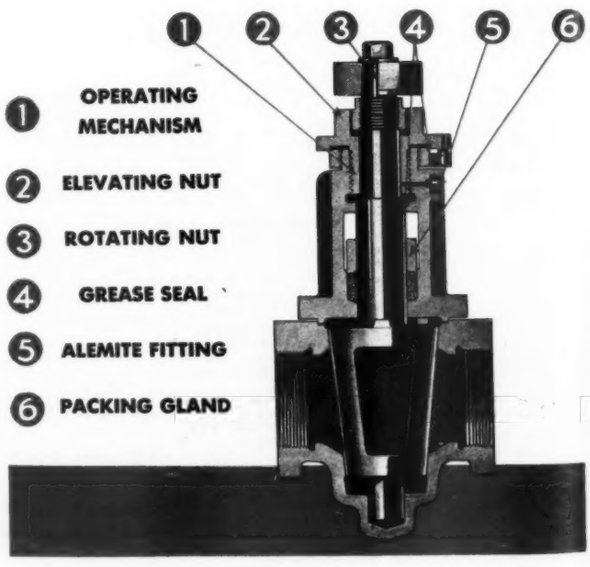
SAFETY



Patents Pending

Designed for OIL—GAS—GASOLINE—STEAM—WATER. For all working pressures up to 1500 pounds. For all working temperatures up to 900° F. Furnished with screwed ends or standard flanges. Made in both full round and elongated plug opening.

THE safety features incorporated in the "Screw Lift" valve which distinguish it from other plug valves, are in no small degree responsible for its acceptance in the refinery « » Note the position of the operating mechanism . . . its complete separation from that part of the assembly subject to line pressure and temperature and the impossibility of contact with the fluids handled. Although the operating mechanism is fully protected against atmospheric moisture, fumes and grit, it is nevertheless readily accessible and not buried deep in the valve assembly « » What other plug valve can be repacked as safely or as easily as the "Screw Lift"? The gland is right there within reach all the time . . . half of the valve needn't be dismantled to get at it. And the gland is just the conventional type with which every mechanic is thoroughly familiar « » The adequately piloted plug, carefully machined, ground and lapped, effects a tight closure at all times regardless of temperature and pressure. A tight shutoff in the lubricated valve is not dependent on a heavy grease filler. The lubricant used in this valve is light and applied by means of the standard grease gun « » The visible stop on the plug lifting nut absolutely prevents jamming the plug in its elevated position « » One quarter turn opens the valve or closes it. Opening or closing can be done much more quickly in emergency than with any other type of valve « » Write for full information.



Michigan Valve & Foundry Company

Columbus Division . . . 411 SPRUCE STREET . . . COLUMBUS, OHIO

H. W. Perritt's No. 2 Bowman-Hicks, 244 ft. S, 122 ft. E, NW cor. SE SW, Sec. 2-7-12.....Drlg. 1,321 ft.
J. M. Tompkins' No. 1 M. R. Stoker, 300 ft. S, 100 ft. W, NE cor. SW, Sec. 10-7-11.....Recmtd. 6⅝-in. 2,362 ft.
J. C. Walton's No. 1 Sabine Lbr. Co., 300 ft. S, 300 ft. W, NE cor. NW, Sec. 11-7-12.....S.D. 1,930 ft.

SABINE PARISH—PLEASANT HILL

John Henry O. & G. Co.'s No. 2 Cooke Land Co., 1,990 ft. S, 1,640 ft. E, NW cor., Sec. 34-10-12.....Drlg. 3,186 ft.

WEBSTER PARISH—SAREPTA

Cassidy & Davis' No. 1 Nickerson, 300 ft. S, 300 ft. W, NE cor. SW, Sec. 29-23-10.....S.D. 150 ft.

ARKANSAS

OUACHITA COUNTY—SMACKOVER

L. H. Hamilton's No. 3 Doyle, 100 ft. E, 400 ft. N, SW cor. SE SE, Sec. 23-15-16.....T.A. 2,020 ft.

OUACHITA COUNTY—STEPHENS

J. D. Reynolds' No. 1 Grayson, Sec. 21-15-15 (Stephens Townsite).....Drlg. 1,905 ft.
Wesson & Bonner's No. 1 Wesson, 500 ft. W, 175 ft. N, SE cor. SW NW, Sec. 22-15-19.....Setting packer to cut off wtr. flow 2,169 ft.

UNION COUNTY—CHAMPAGNOLLE

Ohio Oil Co.'s No. 3 Furlough, 408 ft. N, 192 ft. E, SW cor. NW NE, Sec. 12-17-14.....Derrick.
Ohio Oil Co.'s No. 2 Raulston, 330 ft. S, 330 ft. E, NW cor. NW SE, Sec. 12-17-14.....Derrick.
Ohio Oil Co.'s No. 5 R. Pumphrey, 660 ft. S, 660 ft. W, NE cor. NW, Sec. 12-17-14.....Cmtd. 6⅝-in. 2,985 ft; T.D. 3,007 ft.

UNION COUNTY—EL DORADO

Rice Drlg. Co.'s No. 1 Watley, 150 ft. S, 150 ft. E, NW cor. SW, Sec. 7-17-15.....S.D; repairing rig; T.D. 1,520 ft.
Southern Prod. Co.'s No. 1 Wingfield, NE cor. SE NW, Sec. 16-19-15.....Began second hole Feb. 17; cmtd. 10-in. 103 ft; drlg. 610 ft.

UNION COUNTY—URBANA

Marine Oil Co.'s No. 1-E Thompson, 330 ft. N, 330 ft. W, SE cor. NW NE, Sec. 10-18-13.....Rigging up.
Marine Oil Co.'s No. 2-E Thompson, 330 ft. N, 330 ft. E, SW cor. NE NE, Sec. 10-18-13.....Location.

EAST TEXAS

HARRISON COUNTY

Calatex O. & G. Co.'s No. 6 Argus, 755 ft. N, 699 ft. W, Mile Post 27, in J. Womack Sur.....Location.

PANOLA COUNTY

Ark.-La. P. L. Co.'s No. 13 Louis Werner, 1,590 ft. S, 600 ft. W, SE cor. Carrie Steele tr., B. C. Jordan Sur.....Drlg. 1,774 ft.
Daisy O. & G. Co.'s No. 1 Rucka, John Palmer Sur.....Cmtd. 8-in. 1,900 ft.
Dillon & Bradham's (was W. G. Banks et al's) No. 1 C. O Baldwin, 1,395 ft. W, 1,362 ft. S, NE cor. Baldwin 290 ac. in Hampton West Sur.....S.D. 905 ft.
S. E. Bell et al's No. 1 Burnett Lbr. Co., C, S. B. Hendricks Sur.....Drlg. 3,180 ft.
C. D. Neff et al's No. 6 Brumble, B. C. Jordan Sur.....Derrick.
Knox et al's No. 1 Dunham, Chas. Haley Sur.....Drlg. 3,110 ft.
United Prod. Corp.'s No. 17 Steele, 1,320 ft. N, 660 ft. W, SE cor. C. D. Steele lse. in B. C. Jordan Sur.....Location.

MISSISSIPPI

HINDS COUNTY

Cleve Love et al's No. 2 Ridgeway-McGhee, SE cor. NW, Sec. 2-5-1e.....Rigging up.
Love Pet. Co.'s No. 2 Maley, 700 ft. E, 1,100 ft. S, NW cor. NE NW, Sec. 15-5-1e.....Rig up.
Pirtle & Flint's No. 1 Payne, 450 ft. W, 50 ft. N, SE cor. SW SW, Sec. 27-6-1e.....Drlg. shale 2,378 ft.

RANKIN COUNTY

Miss. G. & F. Co.'s No. 1 Hanna, SW cor. SW NE, Sec. 14-5-1e.....Derrick.
Pioneer O. & G. Co.'s No. 1 Ragland, NE cor. SW SW, Sec. 12-5-1e.....Rigging up.

GULF COAST FIELDS AND WILDCATS

(Continued from Page 58)

Yount Lee Oil Co.'s No. 10 Woodward, southeast.....Drlg. shale and lime 4,502 ft.
Yount Lee Oil Co.'s No. 16 Chambers, Wm. Bloodgood Sur., 50 ft. from W line of tract in line with Nos. 15 and 12 (workover).....Pulling screen to deepen 4,733 ft.
Yount Lee Oil Co.'s No. 18 Chambers, south flank, Wm. Bloodgood Sur., 100 ft. N Sun Oil Co.'s No. 7..Drlg. shale and lime 3,778 ft.; salt 1,758-3,383 ft.
Yount Lee Oil Co.'s No. 19 Chambers, south flank, Wm. Bloodgood Sur., 10 ft. N Sun Oil Co.'s No. 8..Drlg. salt 3,390 ft.; top salt 1,807 ft.
Yount Lee Oil Co.'s No. 6 Phillips, east.....Rig standing.
Yount Lee Oil Co.'s No. 1 Winfree, west.....Drlg. sand, shale and lime 4,800 ft.
Yount Lee Oil Co.'s No. 2 Winfree, west flank, W. D. Smith Sur., 50 ft. from S line and 100 ft. from E line of tract.....Drlg. sand and lime 3,172 ft.

RACCOON BEND—AUSTIN COUNTY

H. R. Flannigan's No. 2 Dietrich.....Drlg. sandy shale 3,670 ft.
Humble & Valley's No. 4 Diemar.....Oil sand 3,455 ft.; comp. flowing 218 bbls. pipe line oil first 24 hrs.
Humble & Valley's No. 3-A Grawunder, Wm. White Sur., 1,100 ft. southwesterly from NE line in center of 72-acre tract.....Location.
Humble & Valley's No. 11 Payne.....Drlg. shale 3,075 ft.
Humble & Valley's No. 12 Payne, Wm. White Sur., 500 ft. SE of No. 9.....Location.
Humble & Valley's No. 1 Martha Remmert.....Derrick.
Humble & Valley's No. 5 Sherrod.....Location.
Humble & Valley's No. 13 Thompson.....Location.

HUMBLE—HARRIS COUNTY

Dunbar & Deering's No. 2 Bennett (workover).....Comp. pumping 25 bbls. oil 4,374 ft.
LaRue, trustee's No. 1 Crane, northwest.....Derrick.
M. LaRue's No. 1 Tuffly, northwest.....Gumbo 1,405 ft.; shut down.
Rio Bravo Oil Co.'s No. 6 fee (workover), W. B. Adams Sur., 50 ft. out of SW cor. 22-ac. tract.....Formerly comp. 4,409 ft. 470 bbls.; sidetracked to 4,373 ft.; set screen and swabbing.
Southern Coastal Oil Co.'s No. 2 Perkins.....Total depth 2,850 ft.; sidetracked 2,500 ft. and drlg. shale 2,529 ft.
Sun Oil Co.'s No. 17 Bender (workover), Adams Sur., 217 ft. E and 50 ft. S of NW cor., Lot 9.....Rig up to deepen 4,412 ft.
Sun Oil Co.'s No. 20 Bender, Adams Sur., Bender south addition, 354 ft. from E line and 50 ft. from S line of Blk. 2.....Drlg. shale 3,510 ft.
Sun Oil Co.'s No. 21 Bender, Adams Sur., Bender South Addition, 300 ft. NW No. 15.....Rig.
Sun Oil Co.'s No. 1 Beck, west flank.....Drlg. shale and shell 4,234 ft.
Trapshooter Oil Co.'s No. 3 Rosenbaum.....Swabbing 4,067 ft.
Trapshooter Oil Co.'s No. 10 Neil, northwest.....Salt 1,806 ft.; standing.

PIERCE JUNCTION—HARRIS COUNTY

Anderson & Plummer's No. 6 Whitehead (workover), J. Hamilton Sur.....Old total depth 6,591 ft.; sidetracked and drlg. rock 3,143 ft.
Bryan Ward, trustee's No. 1 Prudential (workover).....Set 32 ft. 3-in. screen 4,559 ft.; to pump.
Gulf Prod. Co.'s No. 1 Manchester (workover).....Formerly comp. 500 bbls. 3,726 ft.; pulling screen to deepen.
Gulf Prod. Co.'s No. 23 Taylor, east side, James Hamilton Sur. No. 52 (workover).....Total depth 4,857 ft.; sidetracked to oil sand 3,906 ft.; cmtd. csg.
Trapshooter Reilly Oil Co.'s (formerly Mike Kouri's) No. 1 fee, B.B.B.&C. Sur. 1,028, 21 ft. from W line and 20 ft. from S line, Blk. 10.....Total depth 4,020 ft.; sidetracked and drlg. shale 3,675 ft.
Rio Bravo Oil Co.'s No. 14-A Settegast (workover).....Old total depth 5,045 ft.; pulling line to deepen.
Rio Bravo Oil Co.'s No. 102 G.H.&S.A., B.B.B.&C. Sur. No. 1,028, 35 ft. S of C of R.R. track and 50 ft. E of No. 101.....Drlg. rock 1,071 ft.
Smith et al's No. 1 Bender fee, B.B.B.&C. Sur. No. 1,028, 173 ft. from E line and 14 ft. from N line of Lot 40, Jones Subd.....Drlg. sand and boulders 1,075 ft.
Tilton & Perot's No. 1 Gulf fee, B.B.B.&C. Sur., No. 1,028, 330 ft. from E line and 26 ft. from S line, Lot 26, Jones Subd.....Rig.
Superior Oil Corp.'s No. 1 Boyles (workover), B.B.B.& C. Sur. No. 1,028.....Drlg. sandy shale 4,481 ft.
Superior Oil Corp.'s No. 2 Boyles (workover), B.B.B.& C. Sur. No. 1,028.....Total depth 3,874 ft.; to sidetrack.
Warner-Quinlan's No. 2 Minchen, B.B.B.&C. Sur. No. 1,028, 44 ft. from S line, Lot 5, and 134 ft. due W of No. 1 (Lot 7).....Drlg. sand 1,575 ft.

SPINDLETOP—JEFFERSON COUNTY

Yount Lee Oil Co.'s No. 59 McFaddin (workover), Humphreys Sur., 957 ft. from N line and 640 ft. from E line of lease.....Comp. flowing 450 bbls. oil 5,019 ft.
Yount Lee Oil Co.'s No. 146 McFaddin, P. Humphreys Sur., 2,772 ft. from W line and 2,528 ft. from N line of tract.....Rig.

NORTH DAYTON—LIBERTY COUNTY

Harrison Oil Co.'s No. 4 Quintette (workover).....Total depth 6,077 ft. in salt; sidetracked to 4,481 ft.; set 3 jts. screen and 4½-in. liner to top; comp. flowing 300 bbls. on open 4-in. line.

HIGH ISLAND—GALVESTON COUNTY

Marrs McLean's No. 12 Cade (workover).....Total depth 4,552 ft.; twisted off; sidetracked to sand showing oil 3,724 ft.; set 27 ft. 4½-in. screen and liner to top; comp. flowing 574 bbls. net oil, 75% water, on 7/16-in. choke.
Marrs McLean's No. 16 Cade (workover).....Old total depth 3,759 ft.; pulling screen to deepen.
Marrs McLean's No. 20 Cade.....Rig standing.

ORCHARD—FORT BEND COUNTY

Gulf Production Corp.'s No. 22 Moore (workover).....Drlg. hard shale 4,343 ft.
Gulf Prod. Co.'s No. 28 Moore.....Drlg. hard sand and shale 3,348 ft.

HULL—LIBERTY COUNTY

W. B. Flynn's No. 4 Harrison (workover).....Deepened to 3,796 ft.; temp. abd.
The Texas Company's No. 4 Barrow.....Hard sticky shale 4,590 ft.; to test.

CLAY CREEK—WASHINGTON COUNTY

Sun Oil Co.'s No. 2 C. H. Marcus, J. F. Perry Sur., 200 ft. S of N line and midway east and west tract.....Drlg. shale 940 ft.
Sun Oil Co.'s No. 5 Caraway, J. F. Perry Sur., 200 ft. from W line and 600 ft. N of No. 2.....Drlg. shale 358 ft.
Sun Oil Co.'s No. 5 Witt.....Set 65 ft. 4½-in. screen 1,273 ft.; comp. flowing 125 bbls. pipe line oil.

ALLEN—BRAZORIA COUNTY

Mills Bennett Prod. Co.'s No. 2 Reese, Thos. and Wm. Alley League, 870 ft. in southwesterly direction along N line and 720 ft. southeasterly at right angles from said line.....Drlg. shale 4,489 ft.
Mills Bennett Prod. Co.'s No. 2 Random, J. G. and G. W. McNeel ½ League, 860 ft. southwesterly along N line from NE cor. and 100 ft. southwesterly at right angles from said line.....Drlg. sandy shale 4,961 ft.
Mills Bennett Prod. Co.'s No. 3 Allen, J. G. and G. W. McNeel ½ League, 250 ft. E of river and 200 ft. N of Shell's No. 1 Allen.....Salt 1,520-3,528 ft.; abd.

ESPERSON—LIBERTY COUNTY

Cranfill-Reynolds' No. 18 Esperson.....Set 1 jt. 4½-in. screen 3,079 ft.; comp. flowing 456 bbls. 22.1 gravity oil.
Cranfill-Reynolds' No. 8 Moores Bluff.....Set 3 jts. 4½-in. screen 2,329 ft.; comp. flowing 175 bbls. oil.
Cranfill-Reynolds' No. 7 Davis, David Kokernut Sur., 100 ft. S No. 4.....Rig.
Cranfill-Reynolds Oil Co.'s No. 1-C Kirby fee.....Drlg. hard rock 5,186 ft.

HANKAMER—LIBERTY COUNTY

Gulf Production Co.'s No. 12 Boyt, H.&T.C. Sur. No. 22, 500 ft. E No. 11.....Drlg. gumbo 2,062 ft.

SARATOGA—HARDIN COUNTY

Rio Bravo Oil Co.'s No. 109-A Cotton.....Cmtd. 10-in. csg. 502 ft.

MOSS BLUFF—LIBERTY AND CHAMBERS COUNTIES

Gulf Production Co.'s No. 3 McFaddin, east flank.....Drlg. hard shale and lime 5,791 ft.
Humble Oil & Ref. Co.'s No. 2 Breeding, northwest flank.Drlg. shale 902 ft.
Humble Oil & Ref. Co.'s No. 7 Sterling, east flank.....Drlg. shale and lime 5,204 ft.
Humble Oil & Ref. Co.'s No. 2 Sergeant, east flank.....Drlg. shale 3,433 ft.
Texas Gulf Sulphur Co.'s No. 2 W. A. Carter, B. M. Spinks Sur., 203 varas N along E line of 54.2-acre tract from SE cor. and 19 varas W at right angles..Drlg. gyp 937 ft.
Texas Gulf Sulphur Co.'s No. 3 W. A. Carter, B. M. Spinks Sur., 300 varas E along N line 60-acre tract from NW cor. of tract and 50 varas E at right angles.....Location.

REFUGIO—REFUGIO COUNTY

Houston Oil Co.'s No. 14 Pratt-Hewitt-Rooke.....Drlg. sticky shale 4,679 ft.
Houston Oil Co.'s No. 5 Wilson Heard (workover).....Old total depth 3,686 ft.; rig up to work over.
Houston Oil Co.'s No. 4 Mrs. M. H. Ryals.....Sand and shale showing oil 3,654-64 ft.; set 22 ft. 9-in. screen; swabbing.
Houston Oil Co.'s No. 1 Rooke.....Sand showing gas 6,343-57 ft.; to make drill stem test.
Houston Oil Co.'s No. 1 Doughty.....Sand 6,452-65 ft.; set 23 ft. screen; tested salt water; pulled screen and cmtd. bottom of hole; milling out.
Houston Oil Co.'s No. 3 Rose Lambert.....Drlg. hard sand 4,090 ft.
Houston Oil Co.'s No. 1 O'Brien (D.D.), Blk. 5.....Pulling tubing and liner 5,434 ft.
Ed Jones' No. 3 Mitchell, 200 ft. SW Mission River and 250 ft. SE of road in Blk. 13.....Total depth 6,486 ft. in salt water sand; plugged to 6,420 ft.
Luling Oil & Gas Co.'s No. 1 City, Blk. 86.....Drlg. shale and lime 5,950 ft.
Moody-Seagraves-Karona's No. 1 F. Hayser.....Oil sand 6,419-37 ft.; cmtd. 5 3/16-in. csg. 6,425 ft.; drilled plug and set 21 ft. 9-in. screen.
Moody-Seagraves Prod. Co.'s No. 6 Morgan-O'Connor.....Sand showing oil, total depth 6,434 ft.; cmtd. 6⅝-in. csg. 6,426 ft.
Moody-Seagraves Prod. Co.'s No. 7 O'Connor.....Drlg. shale 5,118 ft.
Moody-Seagraves Prod. Co.'s No. 2-A J. F. B. Heard....Rig.
Moody-Seagraves and Phillips Petroleum Co.'s No. 2 Mercy Academy, 167 ft. from N line and 666 ft. from E line of tract.....Drlg. hard shale and lime 4,790 ft.
Moody-Seagraves' No. 1-B O'Brien.....Oil sand 6,462 ft.; cmtd. 5 3/16-in. csg. 6,445 ft.; drilled plug and set 23 ft. 4-in. screen; comp. flowing 420 bbls. pipe line oil, 975 lbs. pressure on csg. and 1,200 lbs. on tubing; ⅝-in. chokes.

Moody-Seagraves' No. 1 Shelly.....Cmtd. 12½-in. csg. 1,233 ft.; changing rigs.

Moody-Seagraves Prod. Co.'s No. 1 Strauch, Blk. 64 (workover).....Oil sand 6,444-55 ft.; cmtd. 5 3/16-in. csg. 6,444 ft.; drilled plug and set 19 ft. 2-in. screen; comp. flowing 150 bbls. "gasoline," 2,100 lbs. pressure on csg. and tubing; 5/16 and ¼-in. chokes.

T. P. Morgan's No. 1-B St. John heirs, 200 ft. from N line and 1,558 ft. from E line of lease.....Set 17 ft. screen 5,517 ft.; swabbing.

Pearson Properties, Inc.'s No. 4 Ryals, Refugio Town-tract, 150 ft. from S line and 190 ft. from W line of Ryals tract.....Drlg. hard sandy lime 2,650 ft.

Ed Price's No. 3 Mission River, Refugio Town tract, 750 ft. up river from No. 2 on S bank of river.....Rig.

Saxet's 4-A Wilson Heard (workover).....Drlg. sticky shale 2,538 ft.

United Prod. Corp.'s No. 3 Fox (workover).....Fishing drill stem 5,240 ft.

United Prod. Corp.'s (Union) No. 11 Fannie Heard.....Fishing drill stem 5,780 ft.

United Prod. Corp.'s No. 12 Fannie Heard.....Location.

United Prod. Corp.'s (Union) No. 2 Moss-Powers, Blk. 109.....Derrick.

United Prod. Corp.'s No. 9 O'Brien, 150 ft. S of S line and 175 ft. E of extended W line of Moody-Seagraves' O'Brien "B" lease.....Location.

United Prod. Corp.'s No. 10 O'Brien, 150 ft. E of E line of Blk. 106, Refugio Townsite, and 428 ft. N of Refugio Town Tract Sur.....Rig.

United Prod. Corp.'s No. 11 O'Brien, 200 ft. from E line and 500 ft. N of extreme S line of lease.....Drlg. surface formation 110 ft.

United Prod. Corp.'s No. 3 Powers, Refugio town tract, 250 ft. W of E line and 200 ft. N of S line of lease (workover).....Drlg. lime 6,045 ft.

United Prod. Corp.'s No. 6 Power, S, Blk. 83, Refugio Townsite.....Location.

United Prod. Corp.'s (Union), No. 8 Powers, Blk. 82.....Oil sand 6,448-57 ft.; cmtd. 5 3/16-in. csg. 6,448 ft.; drld. plug and set 8 ft. 3-in. screen; comp. gas well spraying 60 bbls. "gasoline," 2,100 lbs. pressure on ¼-in. chokes.

United Prod. Corp.'s (Union) No. 6 Nancy J. Ryals.....Oil sand 3,644-54 ft.; cmtd. 8¼-in. csg. 3,643 ft.; drld. plug and set 88 ft. 6¼-in. screen; comp. flowing 700 bbls. oil.

United Prod. Corp.'s (Union) No. 2-A Rose Lambert, 200 ft. out of SE cor., Blk. 1, of town tract.....Rig.

United Prod. Corp.'s No. 2 Mitchell (workover), 150 ft. out of NW cor. Mitchell 150-acre tract.....Drlg. gumbo and lime 5,914 ft.

United Prod. Corp.'s No. 4 Mitchell (workover), 150 ft. out of NE cor. Mitchell 150-acre tract.....Total depth 5,900 ft.; reaming 5,220 ft.

SOUTH LOUISIANA FIELDS
LOCKPORT—CALCASIEU PARISH

Union Sulphur Co.'s No. 2 Martha Moss.....No report.

Vacuum Oil Co.'s No. 9 Bordages.....Drlg. shale and gumbo 6,349 ft.

Vacuum Oil Co.'s No. 12 Miller (workover).....Total depth 4,421 ft.; sidetracked to 3,791 ft.; set 1 jt. screen; comp. 750,000 ft. gas with slight spray oil, 800 lbs. pressure.

Vacuum Oil Co.'s No. 31 Miller.....Drlg. sticky shale 4,253 ft.

Vacuum Oil Co.'s No. 7 State, 319 ft. N and 260 ft. W. SE cor. NE, Sec. 8-10s-9w.....Rig.

EDGERLY—CALCASIEU PARISH

Associated Oil Co.'s No. 5 Paraffine.....Set 1 jt. 3-in. screen 3,714 ft.; bailed salt water.

Rex Petroleum Co.'s No. 2 Prairie Narroni, Sec. 21-9s-11w, 365 ft. from S line and 50 ft. from E line of lease.....Rig.

HACKBERRY—CAMERON PARISH

R. E. Seiss' No. 2 J. M. Vincent.....Shut down 510 ft.

The Texas Company's No. 8 State.....Derrick.

Yount Lee Oil Co.'s No. 34 State.....Location.

Yount Lee Oil Co.'s No. 36 State.....Location.

Yount Lee Oil Co.'s No. 37 State.....Location.

Yount Lee Oil Co.'s No. 38 State.....Location.

Yount Lee Oil Co.'s No. 39 State.....Location.

VINTON—CALCASIEU PARISH

Vinton Pet. Co. (Lucky Ten) No. 1 Lizzo.....Total depth 3,326 ft.; set 16 ft. of 3-in. screen 3,104 ft.; put on pump and sanded up; pulling screen to deepen.

Vinton Pet. Co.'s No. 10 Matilda Gray (workover).....Set screen and liner 3,496 ft.; standing.

Wilson-Broach's No. 7 Wilson.....Set 23 ft. 3-in. screen 3,432 ft.; comp. flowing 610 bbls. pipe line oil on ½-in. choke, 75 lbs.

Wilson-Broach's No. 8 Wilson, Sec. 33-10s-12w, 100 ft. N of Gulf's No. 70 G.&N.G.....Rig.

BAYOU BOUILLON—ST. MARTIN PARISH

Humble Oil & Ref. Co.'s No. 1 Woodyard Lake.....Total depth 6,061 ft.; sidetracking in hard sandy lime 5,503 ft.

Humble Oil & Ref. Co.'s No. 4 State.....Total depth 4,477 ft.; sidetracking in hard sand 4,438 ft.

SWEET LAKE—CAMERON PARISH

Magnolia Pet. Co.'s No. 2 Sweet Lake, Sec. 5-13s-7w.....Drlg. 954 ft.

Pure Oil Co.'s No. 10 Yount Lee.....Sand showing oil 6,805-30 ft.; cmtd. 8⅝-in. csg. 6,796 ft.

PORT BARRE—ST. LANDRY PARISH

The Texas Company's No. 9 Botney Bay.....Rig.

SORRENTO—ASCENSION PARISH

Gulf Refining Co.'s No. 19 United Land Co.....Drlg. gumbo 2,656 ft.

SULPHUR—CALCASIEU PARISH

Union Sulphur Co.'s No. 749 fee (workover).....Total depth 5,316 ft. in salt; sidetracked to sandy shale showing oil 4,119 ft.

Union Sulphur Co.'s No. 762 fee (workover).....Fishing drill stem 5,500 ft.

Union Sulphur Co.'s No. 765 fee, Sec. 23-9s-10w.....Rig.

Union Sulphur Co.'s No. 766 fee, Sec. 29-9s-10w.....Location.

BLACK BAYOU—CAMERON PARISH

Shell Petroleum Corp.'s No. 12 Watkins (workover).....R'g up to work over 5,321 ft.

Shell Petroleum Corp.'s No. 16 Watkins, Sec. 18-12s-12w, 1,590 ft. from E line and 1,610 ft. from N line.....Sand showing oil 4,213 ft.; cmtd. 6⅝-in. casing.

Shell Petroleum Corp.'s No. 2 State, Sec. 18-12s-12w, 1,345 ft. from E line and 1,565 ft. from N line.....Drlg. salt 4,268 ft.

MISCELLANEOUS WILDCATS
TEXAS
AUSTIN COUNTY

Empire Gas & Fuel Co.'s No. 1 Kuntze, San Felipe.....Sand 6,090 ft.; reaming

O'Hara et al's No. 1 Schrader.....Shut down 3,342 ft.

BRAZORIA COUNTY

The Texas Company's No. 1 Ewin, Harvey Little Sur.....Total depth 7,584 ft.; sidetracking in shale 7,421 ft.

Faust et al's No. 5 Faust.....Set 68 ft. 4½-in. perforated pipe 6,220 ft.; flowed fresh water; fishing wash pipe.

Freeport Sulphur Co.'s No. 2,001 fee, Bryan Heights.....Heaving shale 5,260 ft.; reaming 4,580 ft.

Layne et al's No. 7-A Wisdom, Damon Mound.....Reaming 3,557 ft.

Amerada Pet. Corp.'s (Rycade) No. 2 Seaburn, Stratton Ridge.....Drlg. shale and lime 6,863 ft.

United Oil Syndicate's No. 1 Speer, A. A. Talmadge Sur.....Drlg. shale 1,602 ft.

BURLESON COUNTY

Paul Doran et al's No. 1 Sparks, H. E. Davis Sur., 6,700 ft. from S line of survey and 1,600 ft. W of Brazos River.....Fishing 1,300 ft.

Mid-South Oil Co.'s No. 1 Duckworth.....Tested brackish water 2,601 ft.; shut down.

Reynolds Oil Co.'s No. 1 Harris, 500 ft. from W line and 400 ft. from N line of J. M. McKean Sur.....Shut down 400 ft.

CALHOUN COUNTY

The Texas Company's No. 1 Smith, J. Timmons Sur., Will Mousin and Driscoll Sub.....Drlg. gumbo 920 ft.

COLORADO COUNTY

A. H. Eaton et al's No. 1 A. R. Sureck.....Shale 2,057 ft.; shut down.

GRIMES COUNTY

Deerings & Noble's No. 1 Templeton, 6 miles south of Navasota.....Drlg. shale 4,450 ft.

HARRIS COUNTY

Gulf States Oil Co.'s No. 1 Angsperger.....Drlg. shale and lime 5,284 ft.

Humble Oil & Ref. Co.'s No. 4 Minnetex, Mykawa.....Drlg. heaving shale 6,389 ft.

Humble Oil & Ref. Co.'s No. 5 Minnetex, Mykawa, 150 ft. from S line and 200 ft. from W line, Lot 261, Wm. Lovett Sur.....Location.

Sloane Prospecting Co.'s No. 1 Ulrich, Cedar Bayou.....Drlg. sticky shale 5,510 ft.

JACKSON COUNTY

Chicago-Gulf Co.'s No. 1 Rogers (workover).....Rig up to deepen 3,662 ft.

Warner-Quinlan's No. 1 Hungerford, Henry Smith Sur.....Drlg. rock 4,252 ft.

JEFFERSON COUNTY

Humble Oil & Ref. Co.'s No. 1 McFaddin, T.&N.O. Sur. 234.....Drlg. sand 4,774 ft.

Keith et al's No. 1 Reed-Hankamer.....Drlg. gumbo 3,310 ft.

The Texas Company's No. 4 Pipkin, Big Hill.....Drlg. sand 4,774 ft.

LIBERTY COUNTY

Hamm et al's No. 1 Harvard, Davis Hill.....Gumbo 1,015 ft.; shut down.

J. R. Ingram's No. 1 Hornbeck, Clayton, Harper Sur.....Drlg. shale 5,210 ft.

Tucker et al's No. 1 Bell, H.&T.C. Sur. No. 4.....Gumbo 560 ft.; shut down.

MATAGORDA COUNTY

H. C. Cockburn's No. 2 Hawkins, Shepherds Mott.....Set 47 ft. 4½-in. screen 5,221 ft.; tested salt water; standing.

Empire Gas & Fuel Co.'s No. 1 Boker, Citrus Grove.....Total depth 6,295 ft.; drlg. sidetracked hole in sand and shale 6,075 ft.

MONTGOMERY COUNTY

John Deering et al's No. 1 Knight, D. F. Wilden Sur., 125 ft. out of SE cor., J. A. Knight 320-acre tract.....Drlg. shale and gumbo 3,030 ft.

Lake Creek Oil Co.'s No. 1 Hunt, south of Conroe.....Shut down 678 ft.; gumbo.

Price & Wilhite's No. 2 Guerges.....Drlg. sand 3,490 ft.

ORANGE COUNTY

Gulf Production Co.'s No. 1 Miller Vidor Lbr. Co., E Lewis Sur. No. 385.....Drlg. sand and shale 6,114 ft.

Crew Oil Co.'s No. 1 Mansfield.....Drlg. sand 1,100 ft.

SAN JACINTO COUNTY

Arkansas Fuel Oil Co.'s No. 1 A. J. McMurry, A. P. Gardner Sur., 1,255 ft. from N line and 1,945 ft. from W line.....Location.

E. P. Edwards et al's No. 1 Bennett, northwest of Cold Springs.....Spudded and shut down.

TYLER COUNTY

King Oil Co.'s No. 1 Caswell.....Sand and shale showing oil 1,255 ft.; cmtd. 6-in. csg. 1,218 ft.

Allied Petroleum Co.'s (Texas Southern Petroleum Co's) No. 3 Wilson, Mrs. E. Cherry Sur. No. 798, 1,500 varas from W line and 600 varas from N line.....Drlg. hard sand and shale 4,596 ft.

Lew Wentz' No. 1 Long Bell, 800 varas E and 100 varas N from SW cor. James Seals Sur.....Cmtd. 18-in. csg. 170 ft.; drlg. plug.

VICTORIA COUNTY

Newton et al's No. 1 West.....Shut down 1,550 ft.

The Texas Company's No. 2 McFaddin, C. M. B. Hoyd Sur.....Gas well; shut in 2,025 ft.

United Gas Corp.'s No. 1-B McFaddin, M Travieso Sur., 3,700 ft. E and 500 ft. N from NE cor. C. O. Edwards Sur.....Derrick.

WASHINGTON COUNTY

Penn-Tex Oil Co.'s No. 2 Kamas Brenham, S. M. Williams Sur.....Fishing drill stem 950 ft.

Vegua Oil Co.'s No. 1 P. Graves, S. Clampet Sur.....Rig.

Oliver Drlg. Co.'s No. 1-A Hahn, J. H. Alcorn Sur. A-3.....Drlg. hard shale 1,702 ft.

WHARTON COUNTY

H. H. Givans' No. 2 Hudgins.....Changing rigs 1,344 ft.

SOUTH LOUISIANA
CALCASIEU PARISH

Crawford Doyle's No. 1 Johnson, Sec. 23-9s-13w.....Shut down 875 ft.

J. O. Davis' No. 1 Industrial, Sec. 29-9s-10w.....Set 6⅝-in. csg. with 172 ft. 6⅝-in. screen on bottom, 6,568 ft.; drlg. plug; preparing to bail.

Wilfred Lahay's No. 1 Jardell, Sec. 16-10s-12w.....Shut down 3,258 ft.

Dr. Thomas et al's No. 1 John Hewitt.....Location.

CAMERON PARISH

Vacuum Oil Co.'s No. 2 Cameron Meadows, 3,120 ft. S and 1,900 ft. W from NE cor., Sec. 21-14s-9w (500 ft. S No. 1).....Rig.

The Texas Company's No. 7 State, Calcasieu Lake.....Location.

IBERIA PARISH

The Texas Company's No. 6 Vermillion Bay.....Drlg. gumbo 3,191 ft.

Jefferson Lake Oil Co.'s No. 10 Lake Peigneur, Jefferson Island.....Set 84 ft. 4½-in. perforated pipe 1,849 ft.; bailed 15 bbls. daily 21.4 gravity oil; to pump.

Jefferson Lake Oil Co.'s No. 11 Lake Peigneur, Jefferson Island.....Derrick.

IBERVILLE PARISH

Gulf Ref. Co.'s No. 1 Gay, Bayou Choctou.....Sandy shale 4,040 ft.; to sidetrack stuck drill stem 3,960 ft.

Standard Oil Co.'s No. 7 Wilbert, Bayou Blue.....Derrick.

Standard Oil Co.'s No. 8 Wilbert, Bayou Des Glaise.....Abandoned in sand rock 4,284 ft.

Standard Oil Co.'s No. 9 Wilbert, Bayou Des Glaise, 700 ft. E and 760 ft. N of SW cor. SE SW. Sec. 78-8s-8e.....Building derrick.

Standard Oil Co.'s No. 2 Case, Bayou Des Glaise.....Location.

Standard Oil Co.'s No. 1 E. B. and S. P. Schwing, Bayou Blue.....Sandy gumbo 5,426 ft.; re'uilt derrick; reaming to bottom.

Standard Oil Co.'s No. 1 Baist Cooperage, Bayou Blue.....Gumbo 670 ft.; cmtd. 13⅜-in. csg.; repairing rig.

JEFFERSON DAVIS PARISH

H. T. McClain et al's No. 1 Trimble Atterbury, Welsh, Sec. 16-9s-5w.....Drlg. sandy shale 4,828 ft.

A. V. Peters' No. 1 Smith Subd., Welsh, 1,050 ft. N and 180 ft. E SW cor. Sec. 22-9S-5w.....Location.

PLAQUEMINES PARISH

Gulf Ref. Co.'s No. 2-B Buras Levee Board.....Drlg. cap rock 2,305 ft.

Humble Oil & Ref. Co.'s No. 2 Cockrell-Moran, Lake Grand Ecaille.....Drlg. sticky shale 4,953 ft.

The Texas Company's No. 5 State, Garden Island.....Location.

ST. JAMES PARISH

Convent Oil Co.'s No. 2 Jacobs, Sec. 28-11s-6e.....Tested salt water 1,834 ft.; trying to sidetrack stuck drill stem.

ST. MARTIN PARISH

Harrison & Abercrombie's No. 1-A Barras, Sec. 66-11s-6e.....Drlg. shale and lime 6,077 ft.

ST. TAMMANY PARISH

Washington-St. Tammany's No. 2 Cossack, Sec. 5-6s-10e.....Shut down in gumbo 2,031 ft.

TANGIPAHOA PARISH

Joan Development Co.'s No. 1 Lake Superior, Sec. 20-5s-9e, 540 ft. E, 675 ft. N of SW cor.....Total depth 3,035 ft.; trying to set csg.

TERREBONNE PARISH

United Prod. Corp.'s No. 9 Minor, Houma.....Drlg. shale 5,252 ft.

The Texas Company's No. 4 State, Caillous Island.....Driving piling.

The Texas Company's No. 6 State, Caillous Island.....Caping piling.

The Texas Company's No. 1 L.L.&E., Bay St. Elaine.....Hard sand and lime 4,751 ft.; drill stem stuck.

The Texas Company's No. 6 State, Bay St. Elaine.....Location.

The Texas Company's No. 4 State, Dog Lake.....Driving piling.

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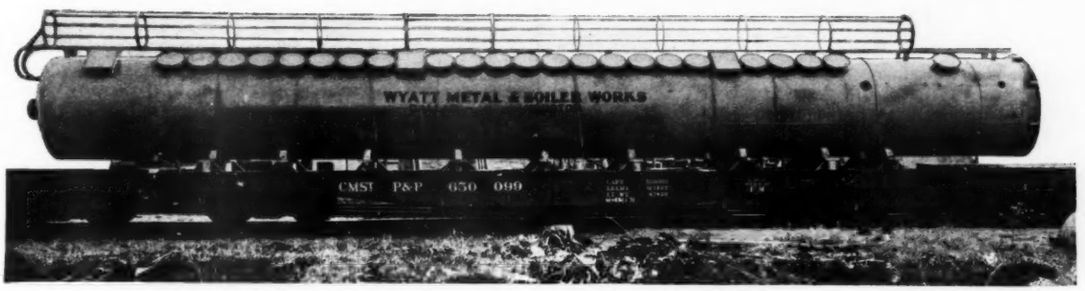

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The Texas Company's No. 5 State, Four Isle ..... Rig.
The Texas Company's No. 3 La. L. & E., Bay Junop .... Location.
The Texas Company's No. 4 La. L. & E., Bay Junop .... Location.
The Texas Company's No. 6 State, Lake Barre ..... Location.
The Texas Company's No. 8 State, Lake Barre ..... Drlg. hard shale 4,626 ft.
The Texas Company's No. 9 State, Lake Barre ..... Drlg. sand and boulders 1,600 ft.
The Texas Company's No. 5 State, Lake Pelto ..... Location.

VERMILLION PARISH

Pure Oil Co.'s No. 1 Southwest, Louisiana Land Co., Gueydan ..... Drlg. sand 5,347 ft.

SOUTHWEST TEXAS PROVEN AREAS

(Continued from Page 55)

Marts and Ertell's No. 1 Abbott, Simon Miller Sur. .....T. D. 1,888 ft.; comp. 35 bbls.
G. Stratton's No. 8 J. C. Abbott, 450 ft. from E line, 150 ft. from S line of 32-ac. tract, S. Miller Sur. ....T. D. 1,900 ft.; abandoned.
Stratton et al's No. 9 Abbott .....T. D. 1,900 ft.; abandoned.
Vitex Oil Co.'s No. 8 Kilgore, Simon Miller Sur. .....T. D. 1,735 ft.; waiting on cement.
Vitex Oil Co.'s No. 9 Kilgore .....T. D. 1,550 ft.; drlg.
Westbrook et al's No. 8 Simmons .....T. D. 1,200 ft.; drlg. shale.

PETTUS AREA—BEE COUNTY

J. L. Mauldin's No. 1 fee, 1,300 ft. N of S line, 150 ft. E of Medio Creek, Kerr Sur. .....T. D. 3,832 ft.; testing.
Houston Oil Co.'s No. 1, Blk. 23 .....T. D. 3,911 ft.; to be deepened.
Houston Oil Co.'s No. 1, Blk. 33 .....T. D. 3,914 ft.; to be deepened.
United Prod. Co.'s No. 32 Ray, G. Habbermacher Sur. ....T. D. 3,701 ft.; drlg.
United Prod. Co.'s No. 31 Ray .....Spudded.
United Prod. Co.'s No. 33 Ray .....Location.
United Prod.'s No. 34 Ray, T. Hanson Sur. .....T. D. 2,700 ft.; drlg.

LASATER POOL—BROOKS COUNTY

Houston Oil Co.'s No. 3 Wormser, Maguella Sur. .....T. D. 3,305 ft.; drlg.

CARTWRIGHT POOL—LIVE OAK COUNTY

Houston Oil Co.'s No. 3 B. L. and C. C. .....T. D. 5,280 ft.; drlg.
Houston Oil Co.'s No. 4 B. L. and C. C. .....T. D. 4,846 ft.; show gas.

CHITTIM POOL—MAVERICK COUNTY

Texas Gas Utilities Co.'s No. 6 Chittim, Sec. 116, Blk. 7, I.&G.N. Sur. .....T. D. 4,135 ft.; drlg.
Texas Gas Utilities' No. 7 Chittim, I.&G.N. Sur. .....T. D. 3,130 ft.; setting 10-in. csg.

AGUA DULCE FIELD—NUECES COUNTY

South Texas Production Co.'s No. 9 Walter, 800 ft. from S line, 460 ft. from E line of Walter tract, in Sec. 34 .....T. D. 1,984 ft.; standing.
Houston Oil Co.'s No. 1-B Ollie Purl .....T. D. 4,849 ft.; show gas.
Houston Oil Co.'s No. 1 Comstock, Sec. 36, Benton Pasture Sur. .....T. D. 4,913 ft.; shut in for pipe line.

SAXET FIELD—NUECES COUNTY

O. C. Best et al's No. 1 Boory .....Derrick.
Houston Oil Co.'s (Andy Bowen) No. 1 Prieur, H. B. Sheppard Sur. .....T. D. 1,465 ft.; waiting for csg.
W. L. Pearson Properties' No. 1 Dunn, 300 ft. S of Bay .....Shut down 2,600 ft.
Saxet Oil Co.'s No. 7 Dunn .....Location.

LAREDO DISTRICT

SCHOOLFIELD-O'BYRNE POOL—DUVAL COUNTY

Duval Oil Corp.'s No. 2 Bishop Cattle Co. .....Rigging up.
Magnolia Pet. Corp.'s No. 2 Willson, Sur. 134 .....Location.

RANDADO POOL—JIM HOGG COUNTY

J. W. Pippin's No. 1 Hinnant, 150 ft. each way from SW cor., Blk. 11, Sur. 147 .....Derrick.

KOHLER POOL—DUVAL COUNTY

Humble Oil & Refining Co.'s No. 50 Kohler, 2,805 ft. from S line, 165 ft. from W line of Sur. 164 .....T. D. 4,763 ft.; drlg.

S. R. C. POOL—DUVAL COUNTY

S. R. C. and Vacuum's No. 3 Duval County Ranch Co., G.C.&S.F. Sur. No. 293 .....T. D. 1,730 ft.; drlg. plugs.

COLE POOL—WEBB COUNTY

O. W. Killam's No. 4 Cuellar .....T. D. 1,705 ft.; drlg.

COLE POOL—DUVAL COUNTY

Southern Oil Co.'s No. 2 King-Harper, 1,794 ft. E line, 729 ft. N line of Sur. 323 .....Location.

REISER POOL—WEBB COUNTY

O. W. Killam's No. 1 Johnson, Sur. 1,617 .....T. D. 1,324 ft.; drlg.

CAROLINA-TEXAS POOL—WEBB COUNTY

George S. Marshall's No. 1 C. W. Webster, 810 ft. from S line, 150 ft. from W line, Sur. 684 .....T. D. 3,960 ft.; standing.

CHABCO REDONDO POOL—ZAPATA COUNTY

Midwest Public Utilities' No. 1 Zarza, 450 ft. SW line, 450 ft. SE line, Blk. 33, Pedernal grant .....T. D. 1,598 ft.; drlg.

JENNINGS-MUCKELROY POOL—ZAPATA COUNTY

Allied Oil & Gas Co.'s No. 12 Guiterrez, 750 ft. from NE line, 3,663 ft. from SE line, Share 4, Fansler Partition, Comitas grant .....T. D. 100 ft.; standing.
Claypool & Nixon's No. 2 Garza, Comitas grant .....T. D. 1,398 ft.; comp. 60 bbls.
Claypool & Nixon's No. 3 Garza, Comitas grant .....Rigging up.
Grimm & Yakey's No. 2 Bustamente, Comitas grant .....Location.
K. & P. Oil Co.'s No. 4 Bustamente, Comitas grant .....T. D. 1,234 ft.; testing sand.
P. H. Meyers' No. 1 Trevino, Sur. 412 .....T. D. 690 ft.; drlg.
S. R. C. Oil Co.'s No. 5-D Montemayor .....Rigging up.
S. T. Phelps (Blankenship) No. 2 Garza, 425 ft. W line, 425 ft. E line, Blk. 2, Sur. 413 .....T. D. 1,740 ft.; drlg.
Shankle and Murray's No. 1 Cuellar, Blk. 6, Sur. 61 .....Spudded.
W. R. Shankle's No. 1 Garza, Blk. 10, Comitas grant ....T. D. 1,415 ft.; comp. 80 bbls.
W. R. Shankle's No. 2 Garza, Comitas grant .....Rigging up.

CUELLAR POOL—ZAPATA COUNTY

Brooklyn Oil Co.'s No. 1 Cuellar, Sur. 119 .....T. D. 1,200 ft.; drlg.
O. W. Killam's No. 40-C Cuellar, Sur. No. 278 .....Derrick.
O. W. Killam's No. 41-B Cuellar, Sur. No. 277 .....T. D. 1,577 ft.; comp. 100 bbls
A. R. McLennan's No. 2 Cuellar, Sur. 277 .....T. D. 150 ft.; drlg.

MIRANDO VALLEY POOL—ZAPATA COUNTY

O. W. Killam's No. 4 Killam, Blk. 11, Sur. No. 182 .....T. D. 1,800 ft.; drlg.

WHITE POINT FIELD—SAN PATRICIO COUNTY

United Prod. Co.'s No. 3 Cage .....Moving in rig.

WILDCAT OPERATIONS IN SOUTHWEST TEXAS

(Continued from Page 55)

E. S. Price's No. 2 Weiss, 900 ft. due SW of No. 1 Weiss, B.&B. Sur. .....T. D. 4,546 ft.; testing.
E. S. Price's No. 3 Weiss, 900 ft. due NE of No. 1 Weiss..Location.
Cosden Oil Co.'s No. 1 Stoltzfus, 2,310 ft. S and E lines of Sec. 14, Rangley Subd. of C. Miller ranch, Uranga Sur. .....T. D. 4,500 ft.; shut down.
Humble and Hurlbut et al's No. 1 J. C. Wood, 150 ft. from NW line, 1,144 ft. from SW line of P. T. Irrigation Co. .....T. D. 5,077 ft.; standing.
The Texas Company's No. 1 McCampbell, 150 ft. from N and E lines of 161-ac. tract, R. Pena Sur. .....Location.
Rowan and Hope's No. 1 Goree, 600 ft. S, 300 ft. W Lot 4, T. B. Barton Sur. .....T. D. 2,000 ft.; drlg.

BEXAR COUNTY

Eckert & Son's No. 3 J. J. Brehm, 545 ft. from N line, 150 ft. from W line of lease, Sur. No. 58 .....Location.
Eckert & Son's No. 6 Brehm, 150 ft. W of No. 5 .....Location.
Eckert & Son's No. 7 Brehm, 150 ft. W of No. 6 .....T. D. 500 ft.; drlg.
Gatlin Oil Co.'s No. 2 I. A. Beck, 150 ft. from SE line, 2,551 ft. from SW line of lease, J. Montes Sur. .....Location.
Gatlin Oil Co.'s No. 4 Beck, Juan Montes Sur. .....Location.
Gatlin Oil Co.'s No. 5 Beck, 300 ft. SE No. 4 .....T. D. 600 ft.; shut down.
Kaye and Uhl's No. 1 Rhode, C. Texada Sur. No. 133 .....T. D. 665 ft.; shut down.
Long and Craig's No. 1 Sandemer .....Location.
McElroy-Hall and Croach's No. 1 Sweeney, 450 ft. NW line, 700 ft. W line of tract, F. R. Hernandez Sur. ...Waiting on cement.
J. M. Russell's No. 1 F. L. Price, 1,500 ft. to N line, 660 ft. W of tract in Angel Navarro Sur. .....T. D. 1,024 ft. in chalk; shut down for csg.
Snyder, Reeves et al's No. 2 Glasscock, 12 miles NE of San Antonio .....T. D. 802 ft.; shut down.
Weibacher et al's No. 1 Ernst, 6,400 ft. S line, 900 ft. W line of J. Christopher Sur. .....T. D. 938 ft.; shut down.
Russell & Moore's No. 3 Mills, Angel Navarro Sur. No. 5 .....T. D. 660 ft.; drlg. shale.
Ueckert et al's No. 1 Palfrey, 1,000 ft. S and W lines of farm .....T. D. 1,809 ft.; shut down.
S. M. Terrell et al's No. 1 A. Beadom, 1,100 ft. from E line, 12,000 ft. from N line of John Barber Sur.....Location.
F. W. Tong's No. 1 Willie Sandemer, 150 ft. from NE and SE lines of the N 20 acres of Willie Sandemer 400-acre tract, Juan Montez Sur. .....T. D. 1,170 ft.; shut down.
Bowman and Waldrop's No. 1 Ridder, 1,000 ft. from S and W lines of 688-ac. tract, J. M. Sur. .....T. D. 2,000 ft.; plugged back to 600 ft.; will put on pump.
Waggoner and Stieren's No. 1 S.A.S.I.F., G. Najar Sur....T. D. 540 ft.; shut down.

CALDWELL COUNTY

Callihan et al's No. 3 W. H. Callihan, 70 ft. N, 65° E of No. 2 .....T. D. 2,525 ft.; shut down.
Jim Harper's No. 1 Tabor, Pablo Martinez Sur. .....T. D. 1,400 ft.; drlg. shale.
Blount and Mills' No. 1 McMahan, 275 ft. from SW line, 75 ft. from SE line of 50-ac. tract, J. Pinchback Sur. .....T. D. 2,185 ft.; comp. 3 bbls. 39.5 gravity oil.

COMAL COUNTY

Caldwell & Lanier's No. 1 T. J. Byler, 175 varas from W line, 370 varas from N line of 320-ac. tract in the H.E.&W.T. No. 5,894 Sur. .....T. D. 600 ft.; pulling 8¼-in. csg.

DEWITT COUNTY

H. T. Roe's No. 1 Leinhardt .....T. D. 2,170 ft.; shut down.

DUVAL COUNTY

Buchanan et al's No. 2 Wood-Welder, S. Alexander Sur. No. 102 .....T. D. 1,521 ft.; shut down.
O'Bryan et al's No. 1 Well, B.S.&F. Sur., No. 868 .....Moving in.

EDWARDS COUNTY

Phillips Pet. Corp.'s No. 2 A. G. Holman, 320 ft. from N and E lines of SE of tract, C.C.S.D.&N.G.R.G. Sur. No. 25 .....T. D. 7,710 ft.; drlg. lime.
James Dalgish's No. 2 Peterson, 850 ft. N line, 1,100 ft. W line of Sec. 82, Blk. E in the H.E.&W.T. Sur...Location.

FAYETTE COUNTY

Elam & Reynolds' No. 1 Florence, M. Muldoon Sur. No. 13 .....T. D. 1,040 ft.; drlg. shale.

FRIO COUNTY

A. H. Wray's No. 1 Burns estate, 700 ft. N, 330 ft. E of C Sec. 123, Antone Hupzor .....T. D. 3,708 ft.; pulling liner.

GOLIAD COUNTY

A. G. Riemenschneider's No. 1 A. T. Fromme, 275 ft. from N line, 912 ft. W line of 300-ac. tract, P. Dexeter Sur. .....T. D. 2,330 ft.; shut down.
Gibson Oil Co.'s No. 1 Cyrus Parks, 3,000 ft. S and 2,500 ft. E of NW cor. of Parks ranch, Ferguson Sur. .....T. D. 5,267 ft.; bailing.
T. B. Slick's No. 1 Poetter, 1,500 ft. from SW line, 900 ft. from SE line of 591-ac. tract, Obid Marshall Sur. .....T. D. 4,313 ft.; shut in for storage.
T. B. Slick's No. 1 Allen, Obid Marshall Sur. .....T. D. 4,312 ft.; setting csg.

GONZALES COUNTY

Andibus & Cummings' No. 1 R. D. and J. C. Miller, 623 ft. from S line, 1,000 ft. from E line, Ann Williams Sur. .....T. D. 2,550 ft.; abandoned.
Acme Oil & Royalty Corp.'s No. 1 H. K. Weber, 2,525 ft. from NW line, 2,250 ft. from SW line, Wright Sur. .....T. D. 2,560 ft.; shut down.
Linden Pet. Co.'s No. 1 Cowley, James Smith Sur. .....T. D. 2,998 ft.; drlg. shale.
Weal Oil Co.'s No. 1 Martin, 360 ft. SE line and SW line of tract, Thomas Moore Sur. .....T. D. 3,576 ft.; drlg. shale.

GUADALUPE COUNTY

O. K. Emerson's No. 1 C. A. Phillips, center of 80-ac. tract, Velda Sur. .....Rigging up.
Luling Oil & Gas Co.'s No. 1 Nixon, E of Darst Creek, L. W. Alexander Sur. .....Rigging up.
Schleyer, Atherton and Armstrong's No. 1 Ogletree, Robert Smith Sur. .....Derrick.

HAYS COUNTY

Harley & Whittington's No. 1 Heidenrich, 4,900 ft. from NW line, 400 ft. from NE line of farm, Hemphill Sur. .....T. D. 2,767 ft.; abandoned.
J. C. Jones et al's No. 1 Byder, John Ingram Sur. .....T. D. 600 ft.; drlg.

JIM HOGG COUNTY

J. D. Pulliam's No. 1 Jones, 1,020 ft. W line, 1,020 ft. S line, Share 5-A, Hinojosa Sur. .....T. D. 2,888 ft.; standing.

JIM WELLS COUNTY

Carail Oil & Gas Co.'s No. 1 McGill, D. Baldwin Sur. ....Spudded.
R. H. Ewell's No. 1 Doering, Blk. 6, Seefield Subd. .....T. D. 500 ft.; drlg.
Gulf Prod. Co.'s No. 1 Shaeffer, J. Pointevent Sur. No. 1..T. D. 510 ft.; drlg.
Prairie Lea Prod. Co.'s No. 1 Oppenheimer .....T. D. 600 ft.; coring.
Smith Clark Co.'s No. 1 Cuero Cattle Co. .....Location.
Stewart and Blair's (E. W. Ogden) No. 1 Farris .....T. D. 2,123 ft.; setting csg.

KARNES COUNTY

J. F. Morrissey et al's No. 1 Rigsdale, 660 ft. SW of C of NE line of 170-ac. farm in the McCouil Sur. .....T. D. 2,180 ft.; drlg.
A. Edmiston's No. 1 Cochran, 150 ft. from S line, 500 ft. from E line of tract, D. B. McConnell Sur. .....T. D. 1,010 ft.; standing.
Hurlbut et al's No. 1 Newberry, 450 ft. SE and SW line of Newberry 428-ac. tract, Carlos Martinez Sur. .....T. D. 2,915 ft.; whipstocked at 2,626 ft.

KENDALL COUNTY

Borgett et al's No. 1 Haag, W. Avery Sur. .....T. D. 1,010 ft.; drlg.
Sitton et al's No. 1 Garvin, C of NE of D. L. Richardson Sur., in the D. L. Richardson Sur., 1 mile NE from Kendalia .....T. D. 1,165 ft.; shut down.
Dixon Oil Co.'s No. 1 Ottmer Behr, W of H.T.&B.R.R. Sur., 3½ miles SE from Sisterdale .....T. D. 2,600 ft.; fishing.
P. B. Sterling's No. 1 R. J. McCrocklin, 1,250 ft. from N line, 250 ft. from W line of the B. G. Owens Sur., 4 miles W from Kendalia .....T. D. 1,600 ft.; shut down.
R. M. Perkins' No. 1 J. Lawhorn, Sec. 10, 2,475 ft. E line, 1,488 ft. S line .....T. D. 706 ft.; standing.
Permian Oil Co.'s No. 1 Taylor, Sec. 18, G.B.&G. Sur. ....T. D. 100 ft.; shut down.

KERR COUNTY

Evans and Gant's No. 1 Selker-Mears, C.C.S.D.&R.G. N.G. Sur. No. 1,605 .....T. D. 600 ft.; drlg.
Evans and Gant's No. 1 E. Young, A. E. Burge Sur. No. 28 .....Drlg. water well.

KINNEY COUNTY

Marion Oil Co.'s No. 2 Jim Clamp .....T. D. 1,389 ft.; standing.

KIMBLE COUNTY

C. L. Bryant et al's No. 1 Lambert, 7,700 ft. N and W lines of F. Lotta Sur. .....T. D. 850 ft.; standing.
Kamon et al's No. 1 Hodges .....T. D. 2,505 ft.; shut down; hole full water.

LASALLE COUNTY

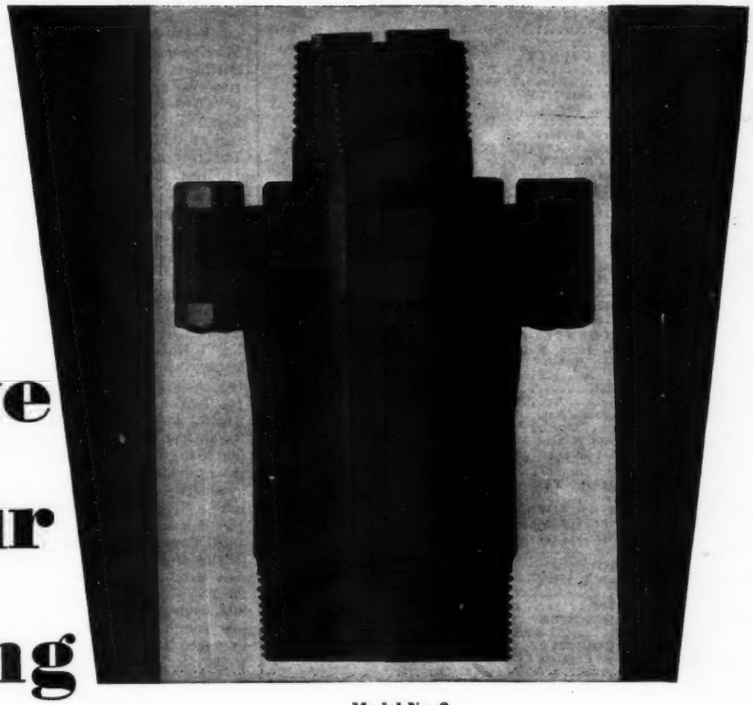
Fred W. Valez' No. 1 Coleman, 200 ft. from S and E lines of SW Sec. 514, B.S.&F. Sur. .....T. D. 40 ft.; standing.

LAVACA COUNTY

Cranfill & Reynolds' No. 1 Hermes, William Ryan Sur....T. D. 3,500 ft.; drlg.
Newton Oil Co.'s No. 1 Reeves, cor. of S line of Reeves tract, John Huesser Sur. .....T. D. 3,340 ft.; fishing.

LIVE OAK COUNTY

Jacob, Buzzini & Pickett, Inc.'s No. 1 C. E. Kay in the Bridget Fadden Sur., 3 miles E from George West...T. D. 4,010 ft.; shut down.



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Houston Oil Co.'s No. 3 Dunning, 330 ft. from NE line and 2,800 ft. from SE line of tract, M. B. Kilvin Sur.—Moving in derrick.
Houston Oil Co.'s No. 1 D. W. Snyder, 630 ft. from S line, 150 ft. from E line of Snyder tract, T. E. Garner Sur.—T. D. 5,386 ft.; coring.
Illinois Exploration Synd.'s No. 1 Reeves-Brown, 1,300 ft. S of Sellars tract, 1,800 ft. E of Ry.—T. D. 2,145 ft.; cleaning out.
Phillips Pet. Corp.'s No. 1 Goebel, Refugio County School Land Sur.—T. D. 1,000 ft.; drlg.
Southern Exploration Co.'s No. 1 Ponder, B.S.&F. Sur., in eastern Live Oak—Derrick.
Sid Keoughan's No. 1 C. E. Terrell, 6,000 ft. from N line, 1,000 ft. from E line, Dan O'Boyle Sur.—T. D. 2,840 ft.; shut down.

LEE COUNTY

Burt et al's (M. D. Rickett) No. 1 R. C. Sanders—T. D. 3,124 ft.; shut down.
A. H. Wheeler and associates' No. 1 fee, Blk. 47, H. Donohue Sur.—T. D. 1,998 ft.; shut down; hole full water.

McLENNAN COUNTY

C. E. Groone et al's No. 1 League—T. D. 1,230 ft.; shut down.
W. L. Murrell et al's No. 1 Hixon—T. D. 780 ft.; abandoned.

McMULLEN COUNTY

Mogul Pet. Co.'s No. 1 Martin, 150 ft. NW line, 150 ft. to SW line of E. Melon No. 212 Sur.—T. D. 632 ft.; standing.
Sheree, Brodie and Emick's No. 1 Shiner, Henry Brewer Sur.—T. D. 1,170 ft.; testing.

MEDINA COUNTY

National Oil Co.'s No. 1 Howard, 1,750 ft. E of W line, 1,854 ft. N of S line of survey in the John George Sur. No. 9, 10 miles S of Dunlay—T. D. 2,618 ft.; shut down.
J. H. Hickey's No. 1 Odon, H Castro Sur. No. 175—T. D. 800 ft.; drlg. shale.
Donaldson Oil & Gas Co.'s No. 2 Adams—Derrick.
C. H. Florian et al's No. 1 Henry Meyer—T. D. 200 ft.; standing.
Caldwell et al's No. 1 L. W. Burrell—T. D. 518 ft.; standing.
M. Eskridge et al's No. 1 Medina Valley Irrigation—T. D. 1,390 ft.; shut down.
Pat Armstrong's No. 1 Crawford, 1,389 ft. N line, 2,550 ft. E line of survey, 487.6 miles W of Devine—T. D. 2,789 ft.; shut down.
Sunflower Oil Co.'s No. 1 Mofield, J. Brothag Sur. No. 532—T. D. 1,212 ft.; standing.

MILAM COUNTY

Rheubotham & Tate's No. 1 Johnson, 325 ft. from N line, 250 ft. from W line of 40-ac. tract, D. Robinson Sur.—T. D. 2,015 ft.; shut down.
Red Bank Oil Co.'s No. 1 Foster, A. G. Berry Sur.—Derrick.
Crawford et al's No. 1 Wall, Reuben Fisher Sur.—T. D. 701 ft.; drlg.
Masters and Pomeroy's No. 1 Pluger, J. J. Acosta Sur.—T. D. 1,136 ft.; drlg.
Kyser, Roberts & Dibbie's No. 2 Ward—T. D. 2,915 ft.; shut down.
J. E. McKee et al's No. 1 Littleton, 150 ft. from N and 225 ft. from W lines of lease, C. Chevallier Sur.—T. D. 510 ft.; shut down.
Peggie Brothers' No. 1 M. Reed—T. D. 650 ft.; shut down.

NUECES COUNTY

Grimm et al's No. 1 William Baur—T. D. 4,600 ft.; drlg.
H. H. Weinert's No. 1 Mohle, 450 ft. from S line, 450 ft. from W line, Sec. 94, Bishop Subd., Palo Alto lands—T. D. 4,295 ft.; drlg.
Moody-Seagraves' No. 1 Sedgwick, J. Dunn Sur.—T. D. 468 ft.; drlg.

REAL COUNTY

Evans & Sprinkle's No. 1 J. M. Auld, H.E.&W.T. Sur. No. 16—T. D. 2,400 ft.; drlg.
McGinley Corp.'s No. 1 Haby, C of SW Sec. 175—T. D. 1,360 ft.; set csg.
Gant-Kilgore and Evans' No. 1 A. D. Auld, C.C.S.D.& R.G.N.G. Sur. No. 23—Spudding.

STARR COUNTY

Los Olmos Oil Co.'s No. 2 Kelsey-Bass, Blk. 6, Porcion 77—T. D. 520 ft.; drlg.
Kush and Duerkson's No. 1 Kelsey-Bass, Blk. 9, Porcion 75, Carmargo Sur.—T. D. 856 ft.; standing.
Menyard et al's No. 1 Sealbury, 150 ft. from E line, 6,550 ft. from N line, Share 5, Porcion 75, Jurisdiction of Carmargo—T. D. 349 ft.; set 8-in. csg.

SAN PATRICIO COUNTY

George B. Pickett's No. 1 Baldwin, 900 varas due E of Denton, 1,200 ft. S of the SE cor. of O'Neill Sur., Abstract 211—T. D. 4,020 ft.; shut down.
Saxet Oil Co.'s No. 1 Carrol, 8 miles N of Gregory—Derrick.

TRAVIS COUNTY

Fort Bend Oil Co.'s No. 1 Engleman, 450 ft. N line, 150 ft. W line of 108-ac. tract, J. H. Denson Sur.—T. D. 1,500 ft.; shut down.
Franklin et al's No. 1 Wilson, A. Alexander Sur.—Derrick.
Waldron et al's No. 1 Cook, D. H. Minor Sur., 8 miles SW of Austin—T. D. 660 ft.; drlg.
Bohls and Wilson's No. 1 Norton, J. Cole Sur.—Derrick.

UVALDE COUNTY

Phantom Oil Co.'s No. 1 Claudt, Sec. 611—T. D. 2,710 ft.; shut down.
Waldrop & Welch's No. 1 E. R. Edmonds, 1,750 ft. NW, 7,200 ft. W of Sec. 71, in the A. Gomez Sur., 8 miles S of Uvalde—T. D. 1,610 ft.; running csg.

VICTORIA COUNTY

Newton et al's No. 1 West—T. D. 1,550 ft.; standing.
The Texas Company's No. 2 McFadden, C. M. Boyd Sur.—T. D. 2,300 ft.; blew out.

WEBB COUNTY

Usher Carson et al's No. 2 Benavides, 150 ft. from S and W lines of Blk. 7, Sur. 1,613—T. D. 854 ft.; drlg.
O. W. Killam's No. 1 Bruni, 2,490 ft. from E line, 1,170 ft. from S line of Sur. No. 77—T. D. 3,284 ft.; drlg.

WILSON COUNTY

Stover and Wren's No. 1 John Ruess, 10,400 ft. from SW line, 2,300 ft. from NW line, O. A. Trevino Sur., No. 19—T. D. 1,100 ft.; shut down.

ZAPATA COUNTY

T. H. Ward's No. 1 Uribe, 150 ft. NW line, 150 ft. SW line, Blk. 8 Subd., Share 7, Partition No. 6, T. Uribe Partition of Jose V. Borrego Sur.—Rigging up.
John Poppas Pool, Inc.'s No. 1 Flores, 2,977 ft. SE line, 6,000 ft. Rio Grande River, Porcion 35—Rigged up.
B. F. Nixon's No. 1 A. Guiterrez, 1770 ft. S line, 332 ft. E line, Lot 5, Blk. 8, Partition 10, Borrego grant—T. D. 50 ft.; standing.
O. W. Killam's No. 3 Slator, Borrego grant—T. D. 2,647 ft.; abandoned.
John J. O'Hern's No. 2 Benavides, Villa grant—T. D. 1,650 ft.; drlg.
Lowe and Rogers' No. 1 Benavides, Sur. No. 11, Blk. 5.—T. D. 400 ft.; drlg.
Penny Prod. Co.'s No. 1 Juan V. Cuellar, Jr., et al, 175 ft. NE line, 175 ft. SE line Poppas Subd., Porcion 33 and 34, Blk. 1, Sur. 2—T. D. 1,966 ft.; testing.
William Marks' No. 1 Flores, Blk. 36, Porcion 37—T. D. 2,290 ft.; abandoned.
National Oil Co.'s No. 1 Luther, 617 ft. NW line, 96 ft. NE line, Blk. 97, De Prom Subd., Porcion 6—T. D. 410 ft.; drlg.
National Oil Co.'s No. 2 Adams, 150 ft. from NW line and SW line, Blk. 11, Borrego grant—T. D. 430 ft.; drlg.
Mackenzie and Talmadge's No. 1 Trevino, 400 ft. SE line, 200 ft. NE line, Blk. 6, Sur. No. 4, Porcion 2 and 3—T. D. 610 ft.; drlg.

ZAVALA COUNTY

Carl Cromwell's No. 1 Whitecotton, C of NW Sec. 1, A.P.&M. Sur.—Location.
F. W. Weigand's No. 1 Gates, 1,320 ft. from N line, 220 ft. from NE cor. Sur. No. 13—T. D. 3,215 ft.; shut down.

OKLAHOMA FIELDS

(Continued from Page 50)

with the main line and a pipe line station may be erected.

Reiter-Foster Oil Corp. and others' No. 1 Finnell, C SE SW, Section 5-19-1w, in the Reiter-Foster Pool, Payne County, was shut down after shooting at 4,940-55 feet.

Other tests in the same county were Twin State Oil Co.'s No. 1 Massey, SE cor. NE SE, Section 17-19-5, which has been completed for 15 bbls. of oil and 20 bbls. of water a day, on the swab. The test was plugged back to 2,925 feet and shot.

Deep Rock Oil & Refining Co. and Continental Oil Co.'s No. 5 Echo Hawk, SW cor. NW NE, Section 9-18-5, was completed for 5,500,000 feet of gas at 2,628-51 feet. The 6-inch casing was landed on top of the gas sand.

Noble County

Prairie Oil & Gas Co. found a showing of oil in the deep formation in its northeastern Noble County test, No. 1 M. Upperman, SW cor., Section 22-22-1, northeast of Perry, in the Otoe Indian Reservation. A showing of oil was found at 4,540 feet. It is the second showing found in the test, the first oil show being at 3,950 feet in the Wheeler sand. The test also had a gas showing at 4,-415 feet. Same company's No. 1 Wentz, NW cor. SW, Section 22-22-1, in the same area, is producing from the Layton sand at a total depth of 3,300 feet. Washoma Petroleum Co. and others' No. 1 Otóe, SE cor. SW, Section 22-22-1, in the same area, was drilling at 3,000 feet and expecting the Layton sand.

Magnolia Petroleum Co. has several tests drilling in the pool west of Perry. No. 1 Roberts, NE cor. SE, Section 21-22-2w, was drilling in shale at 3,000 feet. Same company is reconditioning its No. 3 Young, SW cor. NW, Section 22-21-2w. The total depth of the test was 3,000 feet and it was plugged back to 500 feet and cemented and new hole is being made.

Sinclair Oil & Gas Co.'s No. 2 Waltermire, NE cor. SW SE, Section 33-21-1w, has spudded and shut down.

Greater Seminole Production

The production from the Greater Seminole area for the week ending February 23 averaged 185,422 bbls. a day from 2,-862 wells. The first 12 pools listed below comprise the Seminole area, which averaged 126,711 bbls. a day from 1,870 wells.

Pool—	Wells	Bbls.
Little River	369	21,529
East Little River	82	9,388
Carr City	78	12,550
Maud	133	2,910
Mission	93	5,235
Bowlegs	278	11,729
Earlsboro	283	17,646
South Earlsboro	27	8,038
East Earlsboro	158	17,555
Seminole	254	13,740
East Seminole	33	1,326
Searight	82	5,065
Total	1,870	126,711
Allen	277	11,957
Asher	26	685
West Asher	56	7,466
Konawa	111	14,876
Sasakwa	50	3,700
St. Louis	472	20,027
Grand total	2,862	185,422

Greater Seminole Shipments

The pipe line shipments from the Greater Seminole area totaled 168,654 bbls. a day for the week ending February 23. The daily average shipments by companies were as follows:

Company—	Seminole (bbls.)	Pearson, St. Louis, Asher (bbls.)	Konawa (bbls.)
Barnsdall	2,091	....	....
Champlin	4,091	....	845
Cosden	5,805	....	....
Consolidated	....	2,685	3,008
Deep Rock	2,046	1,844	....
Empire	6,156	....	....
Gulf	14,100	2,625	824
Magnolia	6,408	5,648	2,752
Oklahoma	19,701	188	153
Phillips	1,085	....	....
Prairie	3,356	3,527	558
Prod. & Ref.	1,976	....	....
Pure	7,808	....	....
Shell	5,318	225	1,306
Stanolind	23,373	6,555	4,103
Texas	5,996	3,212	2,046
Tidal	7,860	3,271	....
White Oak	1,305	....	....
Total	118,471	29,380	15,595
Tank cars	5,963		
Grand total	123,779		

Oklahoma City Shipments

The total shipments from the Oklahoma City Field for the week ending February 23 were 661,563 bbls. from the leases. The pipe line shipments from storage were 48,365 bbls. daily. The shipments by companies were as follows:

Company—	Bbls.
Anderson-Prichard	54
Champlin	92
Empire	18,502
I.T.I.O.	3,875
Magnolia	4,909
Oklahoma	12,476
Peacock & Peveto	1,432
Prairie	688
Sinclair to storage	6,479
Slick	27,355
Stanolind	11,313
Operators	2,405
Shell	1,278
Tidal	1,853
Sinclair-Texas	1,797
Total	94,509

Oil purchased from storage was as follows:

Purchaser and Seller—	Bbls.
Oklahoma, I.T.I.O.	4,014
Shell, I.T.I.O.	2,663
Sinclair-Texas, Sinclair	14,066
Stanolind, Slick	22,727
Tidal, Operators	2,675
Empire, Operators	2,214
Total	48,365

Oklahoma City Production

The following wells were on production during the seven days ending February 23, in the Oklahoma City Field, under proration. All other wells were shut in and will be produced according to the curtailment plan.

	S-T-R	Wells	Prod.
Anderson-Prichard:			
Gibbons	1-11-3	4	303
Graham	2-11-3	1	39
Moore	2-11-3	1	67
Orphanage	2-11-3	1	15
Pest House	2-11-3	2	253
Roosevelt Place	2-11-3	5	1,703
A. & P. Phillips:			
Sandness	10-11-3	1	990
Blackstock et al:			
Harvey	15-11-3	1	63
Schilling	10-11-3	1	378
Blackwell-Jones Drlg.:			
Sullivan	1-11-3	1	432
British American:			
Eckroat	10-11-3	1	931
Holmes	10-11-3	7	1,318
Chattam:			
Lindsey	2-11-3	1	1,054
Coline:			
Clour	23-11-3	16	1,795
Warren	18-11-2	8	42
Continental:			
Sudik	6-10-2	4	229
Vinita Park	2-11-3	2	227
Cromwell-Franklin:			
T. Park	13-11-3	32	2,565
Denver:			
Harvey	15-11-3	1	1,095
Whitten	14-11-3	1	247
Empire:			
Refinery Site	3-11-3	1	1,241
Hall-Briscoe:			
Grace	3-11-3	1	43
Lindsey	14-11-3	1	63
I.T.I.O.:			
Banta	18-11-2	1	9
Bod. Anderson	30-11-2	3	54
Borden	23-11-3	1	22
Brokaw, A.	13-11-3	4	4
Brokaw, C.	13-11-3	4	265
Butterfield	11-11-3	1	154
Button	19-11-2	5	24
Canfield, L.	19-11-2	2	7
Canfield, Butt	19-11-2	3	16
Carrico	14-11-3	5	200
Coppinger	11-11-3	8	277
Corff	11-11-3	5	483
Drake	14-11-3	2	9
Eacock	11-11-3	2	58
Emmerson, N.	30-11-2	11	38
Farley, E.	24-11-3	1	59
Farley, L.	19-11-2	4	548
Farley, Fuzzell	19-11-2	2	269
Ferndale, Comm.	11-11-3	5	288
Fortson, E.	24-11-3	3	6
Foster	24-11-3	1	1
Fox	14-11-3	1	158
Funk	11-11-3	1	89
Fuzzell, M.	19-11-2	3	21
Habegger	14-11-3	2	59
Hammer	11-11-3	2	178
Handl	11-11-3	1	93
Hiddleston, S.	19-11-2	1	4
Huffman	14-11-3	2	167
Ivanhoe	15-11-3	2	291
Johnson	25-11-3	9	199
Jones, H. W.	1-11-3	4	513
Jones	31-11-2	14	316
Jones, Comm.	1-11-2	4	717
Knox, May	14-11-3	4	183
Lawrence Place	15-11-3	3	1,723
Lemmon	11-11-3	5	295
Lindsey	15-11-3	1	79
Mid-Texas	23-11-3	1	62
M. K. & T.	33-12-3	4	958
Oklahoma S. Land	36-11-3	8	996
Pasadena Heights	14-11-3	5	310
Peterson, Sad	25-11-3	8	769
Phelans	15-11-3	2	11
Phillips	1-11-3	1	481
Salasman	32-11-2	5	25
Spannagle	15-11-3	1	523
Speegle et al	24-11-3	3	23
Spillman	14-11-3	3	134
Starkey	11-11-3	2	218
Sudik	31-11-2	10	2,662
Terrace Lawn	10-11-3	1	885
Thelmer, E.	12-11-3	8	498
Trosper	13-11-3	11	774
Trosper, Clar.	14-11-3	4	568
Trosper, C. E.	11-11-3	1	94
Trosper, E.	14-11-3	2	350
Trosper, H. G.	14-11-3	7	557
Trosper, L.	12-11-3	2	179
Trosper, P.	18-11-2	1	71
Trosper, Hughes	11-11-3	1	147
Unsell, M.	23-11-3	6	748
Unsell-Krager	23-11-3	3	155
Viewpoint	10-11-3	4	3,322
Warden, M.	24-11-3	1	89
Waters	23-11-3	6	76

(Continued on Next Page)

	S-T-R	Wells	Prod.
Webber-Wall	14-11-3	1	84
Warner, Farley	23-11-3	3	90
Wheeler	13-11-3	3	27
Wilkie-Ander.	25-11-3	3	83
Williams	23-11-3	1	50
Williamson, Can	24-11-3	2	8
I.T.I.O. et al:			
Boulevard, Add	14-11-3	1	34
Johnson-Dabney:			
Foote	10-11-3	1	500
Julian:			
Houser	14-11-3	1	194
Shepard	14-11-3	1	229
Walker	10-11-3	1	115
Kedberg:			
Burns	2-11-3	1	11
Mabee:			
Rusty	10-11-3	1	626
Mid-Kansas:			
Browning	18-11-2	2	5
Forston	24-11-3	5	4
Mollman	23-11-3	4	374
Trosper, D. B.	19-12-1	1	159
Minnehoma:			
Pugh	2-11-3	1	1,393
Oils, Inc.:			
Hathaway	2-11-3	1	1,085
Ross	2-11-3	1	1,378
Phillips:			
Blazier	10-11-3	1	1,175
Carey	2-11-3	1	59
Ciger	2-11-3	1	2,301
Day	2-11-3	1	2,041
Hankins	2-11-3	1	94
Harrell	2-11-3	1	125
Jones	1-11-3	1	14
King	10-11-3	1	898
Lybrand	2-11-3	1	1,067
Nunn	10-11-3	1	1,571
Rallen	2-11-3	1	798
Roden	2-11-3	1	1,842
Unruh	2-11-3	1	1,308
Plains:			
Saddler	12-11-3	1	210
Prairie-Slick:			
Hiddleston	19-11-2	7	113
Sigman	32-11-2	7	404
Reynolds, W. R.:			
Hasting	1-11-3	1	1,561
Shaffer, J. C.:			
Childs	14-11-3	1	11
Shell:			
Potty	30-11-2	7	233
Sinclair:			
S. Land No. 54	36-11-3	16	3,822
S. Land No. 67	36-11-3	5	989
Stamper	30-11-2	6	24
Vencl	31-11-2	16	3,297
Sinclair-Amerada:			
Donnell	23-11-3	1	333
S. Land No. 69	36-11-3	3	1,477
Skelly:			
Fields	10-11-3	1	288
Harper-Turner	3-11-3	1	34
Hoops	31-11-2	8	294
Skelly et al:			
Hurt	2-11-3	1	1,865
Dillon	2-11-3	2	592
Tanner	10-11-3	2	471
Slick, T. B.:			
Campbell	3-11-3	3	4,539
Classen	2-11-3	4	7,989
Daugherty	2-11-3	1	635
Foote	2-11-3	3	489
Foote-Briscoe	2-11-3	1	7
Frisco	3-11-3	2	1,413
Glidden	13-11-3	2	56
Harrison	10-11-3	1	18
Moore	2-11-3	1	5
Page	14-11-3	2	252
Thornton	15-11-3	1	131
Whitfield	34-11-3	1	1,134
Wilson	2-11-3	1	3,861
Slick, T. B., et al:			
Clegg	2-11-3	2	537
Danreuther	2-11-3	3	161
Miller	2-11-3	1	72
Rodman	2-11-3	1	55
Townsend	1-11-3	2	52
Carter	1-11-3	1	144
Slick-I.T.I.O.:			
Houston	2-11-3	1	115
Sun Ray:			
Donaven	34-12-3	1	141
Harris	2-11-3	1	239
Mead	34-12-3	1	1,624
Olafson	2-11-3	1	60
Twyford-Smith	10-11-3	1	209
Wirt Franklin:			
Holder	2-11-3	2	125
Lowery	12-11-3	10	651
Shehan	2-11-3	2	30
Theimer	2-11-3	13	467
Wright	2-11-3	3	13
Wright-Smith:			
Smith	2-11-3	2	525
Total		727	100,170
Last week		718	91,480

New wells, 9. Increase, 8,690 bbls. Average per well for pool, 139 bbls.

Building Gasoline Plant

The Eason Oil Co. has started construction work on a two-unit gasoline plant on its discovery lease west of Guthrie in Logan County. The discovery well was drilled on Katscher lease in Section 34-17-4w, and is making approximately 270 bbls. of oil and 5,000,000 feet of gas a day. The gas is believed to test around 2 gallons of gasoline per 1,000 feet of natural gas.

Mid-Kansas Oil & Gas Co. and Ramsey Petroleum Co.'s No. 1 Heitholt, NW cor. SE SE, Section 33-24-3w, Garfield County, has spudded. Other tests in the county were J. V. Bailey and others' No. 1 White, SE cor. NW, Section 9-24-6w, was cleaning out after being shut down at 5,833 feet. Continental Oil Co.'s No. 1 Looman, NE cor. SE, Section 9-20-4w, was plugged back from a total depth of 5,735 feet to 5,200 feet, where it is drilling deeper. Tom Slick Oil Co.'s No. 1 Fulkerson, NW cor. NE NW, Section 15-20-4w, was drilling deeper at 4,745 feet. The test was shut down for several months at 4,354 feet.

In Kay County, the Wilright Gas Co. and others' No. 1 Wildegrube, NE cor. SW, Section 14-27-1, had the top of the Mississippi lime at 3,800 feet, and a sand from 3,840-50 feet with water, where it is shut down.

Carter County

Don Phillips has the rig up for No. 1 P. H. Lyles, SE cor. SW NE, Section 28-2s-2w.

Creek County

A. A. Bailey and others made location for No. 4 Weaver, NW cor. SW NW, Section 18-19-9. Holmes Oil Co. moved a machine in for No. 1 Morrison, SE cor SW, Section 32-19-10. Wilson Petroleum Co.'s No. 1 Cat, SE cor. SW, Section 31-16-9, an old well being deepened, is drilling by tools. Fogle and others' No. 2 Strip, SW cor. NE SW, Section 24-19-7, has been abandoned at 2,757 feet. Gled Oil Co.'s No. 1 Travis, NE cor. SE NE, Section 13-19-8, has been completed for 165 bbls. in sand 2,185-2,220 feet. A. A. Bailey & Johnson's No. 3 Weaver, SW cor. NW NW, Section 18-19-9, made 25 bbls. in sand 2,397-2,479 feet. Burton & Holmes' No. 1 Snakeya, SE cor. SW SW, Section 5-18-10, is dry and abandoned at 2,301 feet. Producers & Refiners Corp.'s No. 1 Miller, NW cor. NE NW, Section 30-17-8, has been completed for 4,000,000 feet of gas in sand 1,010-75 feet. Dixie Drilling Co.'s No. 1 Lewis, NE cor., Section 7-14-10, is a dry hole at 3,443 feet.

Hughes County

Empire Oil & Refining Co. and others' No. 1 Scroggins, SW cor. SE SE, Section 20-7-8, is dry and abandoned at 4,262 feet.

Jefferson County

C. D. Chenault's No. 1 R. C. Grover, NE cor. SW SW, Section 24-7s-6w, has drilled to 80 feet and shut down.

Lincoln County

Coline Oil Co.'s No. 2 Tillford, SW cor. NW NE, Section 7-14-4, is rigging up rotary tools. Magnolia Petroleum Co.'s No. 2 Tillford, NW cor. SW SE, Section 7-14-4, is spudding.

Muskogee County

O. K. Petroleum Co. has a machine on the location for No. 1-A S. Grayson, CNL NW NW, Section 29-16-15. John Aggas' No. 6 M. Hawkins, SW cor. NW SE, Section 28-16-15, has been completed for 1,301,800 feet of gas in sand 1,393-1,422 feet. D. L. T. Oil Co. and others' No. 2 L. Mackey, SE cor. SW SW, Section 9-15-18, has been completed for 5 bbls. in sand 1,011-24 feet. Robinson Oil Co.'s No. 1 W. Brown, SE cor. NE, Section 18-13-16, made 8 bbls. in sand 2,057-95 feet.

Okfuskee County

M. H. Watts made location for No. 1 Chaplin, SW cor., Section 4-11-10.

Okmulgee County

Keithly and others' No. 3 D. Harris, SE cor. NE SE, Section 1-14-14, an old well deepened to 1,857 feet, is dry and abandoned.

Oklahoma County

T. B. Slick estate is erecting the rig for No. 3 Frisco, CSL NE NW SE, Section 3-11-3w, Oklahoma City Pool. No. 1 Whitfield, SW cor. SE SE, Section 34-12-3w, has been completed for 7,938 bbls. in four hours in Wilcox sand 6,230-6,485 feet. Sunray Oil Co.'s No. 1 Mead Addition, SE cor., Section 34-12-3w, has been completed for 20,321 bbls. in 7½ hours from a total depth of 6,416 feet. Empire Oil & Refining Co.'s No. 1 Refinery Site, SW cor. SE NE NW, Section 3-11-3w, topped Wilcox sand at 6,312 feet, had sand to 6,452 feet, drilled to 6,485 feet and made 8,707 bbls. in eight hours. Anderson & Prichard and Phillips Petroleum Co.'s No. 1 Sandness Community, CSL NE SE NW, Section 10-11-3w, had Wilcox sand from 6,316-6,515 feet, drilled to 6,519 feet and made 6,932 bbls. in four hours. Indian Territory Illuminating Oil Co. and others' No. 1 Terrace Lawn, CNL NE, Section 10-11-3w, topped the Wilcox sand at 6,273 feet, had base of sand at 6,360 feet, total depth 6,365 feet and made 6,193 bbls. in four hours. No. 2 View Point, SE cor. SW SE, Section 10-11-3w, topped Wilcox sand at 6,390 feet, drilled to 6,480 feet and made 5,664 bbls. in four hours. Phillips Petroleum Co.'s No. 1 Blazier, NW cor. NE SE NW, Section 10-11-3w, made 8,227 bbls. in four hours on a 4-inch choke, producing from Wilcox sand topped at 6,320 feet, total depth 6,500 feet. No. 1 Nunn, NE cor. SE NE NW, Section 10-11-3w, has been completed for 11,001 bbls. in four hours on a 4-inch choke, producing from Wilcox sand topped at 6,323 feet, total depth 6,505 feet. Sinclair Oil & Gas Co.'s No. 7 School Land No. 67, NE cor. NW SE, Section 36-11-3w, went into Wilcox sand at 6,754 feet, drilled to 7,384 feet and plugged back to 6,493 feet where it swabbed 213 bbls.

Osage County

The Prairie Oil & Gas Co. made location for No. 1, SW cor. NW NW, Section 16-25-8.

Payne County

Hilton Phillips' No. 1 Workman, NE cor. NW SE, Section 24-18-4, is a rig. Deep Rock Oil Corp.'s No. 1 Little Chief, NW cor. NE, Section 4-18-5, is an old well drilling deeper at 2,320 feet.

Pittsburg County

Midwestern Oil & Gas Co. has a machine on the location for No. 1 Mattocks, C NW SE, Section 8-7-18. No. 1 White, SE cor. NE SE, Section 8-7-18, has been completed for 21,750,000 feet of gas in sand 1,891-2,110 feet.

Pontotoc County

Benedum & Trees' No. 1 J. Burk, SW cor., Section 28-5-5, has been completed for 72 bbls. in sand 2,330-43 feet.

Pottawatomie County

Strapp & King's No. 1 Earlsboro Townsite, SW cor. NW, Section 8-9-5, made a 20-bbl. well in Wilcox sand 4,337-51 feet. Twin State Oil Co.'s No. 4 Archer, NE cor. NW SE, Section 22-6-3, West Asher Pool, has been completed for 1,530 bbls. in sand 3,567-92 feet.

Seminole County

Mid-Kansas Oil & Gas Co. and Ramsey's No. 5 Davis, NW cor. SE NW, Section 30-8-8, Wewoka Townsite Pool, is a cellar. Oils, Inc., has the cellar dug for No. 1 Fisher, NW cor. SW, Section 12-7-7. Mid-Kansas Oil & Gas Co. and Ramsey's No. 4 Davis, NW cor. SE SW, Section 30-8-8, flowed 4,407 bbls. from Wilcox sand 3,970-83 feet. Deep Rock Oil Corp.'s No. 4 Douglas 50 acres, SE cor. NW, Section 30-8-8, has been completed for 10,880 bbls. in Wilcox sand 3,930-52 feet. No. 5 Douglas 50 acres, NW cor. SE, Section 30-8-8, made 960 bbls. from sands 3,013-25 feet and 3,125-64 feet, total depth 3,212 feet. No. 3 Douglas 60 acres, NE cor. SW, Section 30-8-8, has been completed for 4,820 bbls. in Cromwell sand 3,080-3,250 feet after being plugged back from 4,215 feet. Mid-Continent Petroleum Corp.'s No. 1 J. Harjo, SW cor. NE NW, Section 6-5-6, is dry and abandoned at 2,730 feet.

Tulsa County

Murray and others moved a machine in for No. 3 McIntosh, NW cor. SW SE, Section 17-19-14. Murphy and others' No. 1-A McIntosh, NW cor., Section 28-19-14, is rigging up. Ohio Petroleum Co. has a machine in for No. 2 Haikey, SE cor. SW SW, Section 33-18-14. McDonigal and others' No. 1-A Thompson-Cowan, SW cor. NE SW, Section 7-19-14, has been completed for 7 bbls. in sand 1,270-83 feet, total depth 1,330 feet. Murray and others' No. 2 McIntosh, CSL SW SE, Section 17-19-14, has been abandoned after spudding. Chandler and others' No. 2 McIntosh, NE cor., Section 29-19-14, made 2,750,000 feet of gas in sand 1,296-99 feet.

Wagoner County

J. A. Barbre and others moved a machine in for No. 2 G. Childers, CWL NW SW, Section 28-18-17. P. Boyle and others' No. 1 M. Ballard, CWL SE NE, Section 16-16-15, is dry and abandoned at 1,780 feet.

SOUTHWEST TEXAS

(Continued from Page 55)

Houston Oil Co. owns the entire field and gas production is several years old at a little below 2,200 feet. Recently the company completed No. 1-A Boothe, three-quarters of a mile north at 5,277 feet and now No. 4 Brown Land & Cattle Co. shows gas at 4,846 feet which was not encountered in other tests. The drill stem stuck, otherwise it would have probably blown out. Gas at this depth seems to indicate a faulted condition not suspected before.

Another feature of interest was the Houston Oil Co.'s No. 1-B Ollie Purl in the Agua Dulce Field in western Nueces County and about 25 miles south of the Cartwright Field. No. 1-B Ollie Purl on drill stem test came in gas with an odor of gasoline after the valve had been left open 10 minutes. The well is 7,500 feet southeast of the discovery gas well of the Agua Dulce Field producing at 2,000 feet. It is 9,200 feet southwest of the Houston Oil Co.'s No. 1 Comstock producing gas and a small amount of light oil at 4,913 feet. The new well is in Lot 1, Block 7, of the Ross Peters Subdivision. Later in the week drilling was resumed and last depth reported was 4,934 feet where it encountered fresh water sand under a rock. Present plans are understood to be to drill to 5,500 feet unless an oil well is had at less depth.

Fort Bend Oil Co. has finally abandoned its No. 1 Newberry in the southern part of Karnes County and north of the Pettus Field at 4,003 feet. It is more than an ordinary disappointment because it looked for a long time to some as though it might make a well.

McMullen County

In McMullen County, about the center of the county, Whall, Sherer and others are shut down at 1,170 feet in their No. 1 Shiner waiting for it to quit raining so they can get out more fuel and arrange to test a showing that looks to have possibilities. The well had minor showings of gas, one at only 85 feet, one at 274 feet and another at 1,035 feet.

In Hays County, Harley & Whittington have abandoned their No. 1 Heidenrich, it being agreed that it is in schist at 2,760 feet.

In Frio County, A. H. Wray, who has a test in the northeastern corner of the county on the Burns estate land that has been holding interest for several months, pulled in the derrick. It has been rebuilt and is about ready to start up again. Rycade Oil Corp. is doing a lot of core drilling in the southeastern part of Frio County.

Southwestern extension of the Escobas Pool in northeastern Zapata County got some more wells the past week. A new sand was discovered there recently at around 1,400 feet being about 100 feet deeper than the regular sand at the north. Claypool & Nickson completed their No. 2 Garza at 1,398 feet for 60 bbls. Their No. 1 completed a week ago was for 200 bbls. W. R. Shankle completed his No. 1 Garza in Block 10, Zorro Subdivision of the Comitas ranch in the same part of the field at 1,415 feet with sand from 1,409 feet for 80 bbls. of oil. He is starting his No. 2 and Claypool & Nickson are starting their No. 3.

General Conditions

The number of tests shut down or standing in Southwest Texas a month ago was 115. Last week it dropped to 91. The number of tests actively drilling has not increased much but last week was at 111 and it had been below 100. There were 20 new locations announced the past week and 17 of them have already started operations. Most of them are locations in unproven territory. Simms Oil Co. has made location for another test in the Manford tract northeast of the Darst Creek Field where R. R. Penn brought in a well and sold a half interest to Simms soon after the discovery well of the Darst Creek Field was brought in. Two or three other producers were drilled around it.

Peterman & Minahan have made location for No. 1 Palacios, 2½ miles southeast of the Randado Pool in Jim Hogg County. The test is in Block 14, Survey 231. They are expecting to pick up production at 1,800 feet or less.

ON THE ROAD TO MANDALAY

E. L. Varney, construction engineer for C. F. Braun & Co., Inc., San Francisco, has sailed for Burma to supervise the installation of two Braun constructed recovery plants in the oil fields near Mandalay. Other Braun plants have been giving service in Persia and western Asiatic fields and in Sumatra, Venezuela, Colombia, Argentina and Peru.

CLASSIFIED WANTS

Read by Oil Men Everywhere

RATES

The rates for Classified Advertisements are 35 cents a line for the first insertion and 25 cents a line for each additional insertion. Six words usually constitute a line. The following table will enable you to figure the cost of your advertisement:

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Compute white space at the above rates.

Mail your Classified Advertisement to

THE OIL AND GAS JOURNAL
Tulsa, Oklahoma

FOR SALE—EQUIPMENT

FOR SALE—2 No. 12 and 2 No. 11 Sweetland Filter Presses, some with monel leaves; 5 Sweetland Filter Presses, No. 9, No. 7, No. 2; 6 No. 4 Valles Filters; 2 150 HP Fitzgibbons Boilers; 2 Skinner Unaflow Engines, direct connected to 2 200 KW Crocker Wheeler Generators, 125 to 250 volts. Installed three years; Miscellaneous Compressors, Storage Tanks, Pumps. Consolidated Products Company, Inc., 17-20 Park Row, New York City. Barclay 0600.

WAUKESHA MOTORS

For sale—84 Model WKS 4-cylinder, 6¾"x8", 1,000 r.p.m., rated 120 h.p., industrial type, equipped with twin disc clutch and power take-off, late series, like new guaranteed; 34 of these motors are equipped for operating on artificial or natural gas. Price $950. Mertes Machinery Co., Milwaukee, Wis.

GOOD USED PIPE

20 miles of 4" line pipe either weld or screw joint. Quote price f.o.b. your loading point. Box E-421, The Oil and Gas Journal, Tulsa, Okla.

16" LANDIS pipe machine. Complete, 95% new. 24"x22' Bradford lathe, 6" hole in spindle; taper attachment; complete. 12"x10" Ingersoll-Rand Type ER1 air compressor. Motor drive, complete. Also large stock of other machine tools. Five hundred machines in stock. Send for catalog. Terms to responsible parties.
Cincinnati Machinery & Supply Co.
26 W. Second St. Cincinnati, Ohio

USED EQUIPMENT

For gasoline, production, pipe line and drilling branch of oil industry. Enormous stocks of equipment to choose from at minimum cost. Let us save you money by serving as a medium through which to buy and sell your used equipment.

OIL FIELD EQUIPMENT EXCHANGE
Mid-Continent Oil Companies
Official Clearing House

808 Ritz Bldg. Tulsa Phone 4-8168

FOR SALE—EQUIPMENT

FOR SALE—New recessed line pipe couplings and Std. merchant couplings—sizes ⅛" to 12". Lowest prices. Also short ends new seamless and lap weld pipe, 1" to 24" diameter, Std., Ex. Hvy. and double Ex. Hvy.—lengths 1 foot to 8 feet. Mid-Valley Steel Co., St. Louis, Mo.

100 OIL and gas engines for sale. Superior, Reid, Franklin, Foos, Black Bear and Primm 15 to 80 H.P. in fine order; new models, low prices. Edward A. Schambs, Jr., Box 868, Wichita Falls, Tex. Telephone 6356.

EQUIPMENT WANTED

WANTED — Swan or Wilson underreamer to underream 20-inch 90-pound casing. Sewell Well Co., 1627 Locust St., St. Louis, Mo.

WANTED—Used 35 h.p., 4-cycle Superior gas engines, complete with clutches, priced right and in good condition. M. & V. Tank Co., Wichita Falls, Tex.

BUSINESS OPPORTUNITIES

FOR SALE—A producing gas property earning about $1,500 monthly; well equipped; several locations, both gas and oil. H. A. Hopkins, Box 1112, Cisco, Tex.

EXTREME LOW DRILLING COSTS and gusher (up to 5,000 bbls.) production make Williamson County, Texas, serpentine plugs the best venture. $4,000 to $8,000. Covers entire cost of blocking and the drilling of the well. Inquiry solicited.
NICOLLE & NICOLLE
Geologically Selected Drilling Blocks
P. O. Drawer 1720 Fort Worth, Texas.

OIL located before drilling. Geophysical method. Toggodometer Instrument; take pay in oil. No oil, no pay, except traveling and testing expenses, 95 per cent accuracy. O. P. Coffin, Caddo, Tex.

FOR SALE—A quantity of East Texas crude oil, f.o.b. cars at Henderson and Kilgore, Tex. W. M. Worthen, Blackstone Hotel, Tyler, Tex.

JOBERT OIL AND DRILLING COMPANY specializes in drilling propositions and producing and non-producing royalties. 319 Tradesmen's Bank Building, Oklahoma City, Okla.

TEXAS: Young County Leases offset well now drilling. $20.00 per acre. Production close. High gravity oil. Long life wells. 1110 Bass Bldg., Enid, Okla.

FOR SALE—My patent, and contract now in effect with manufacturing company, covering WELDLESS ELEVATOR LINKS. Royalty runs until 1947. Write Box E-411, The Oil and Gas Journal, Tulsa, Okla.

FOR SALE—New franchises and distribution systems just completed on group small towns with pipe line connecting; unlimited supply cheap gas. Box E-426, The Oil and Gas Journal, Tulsa, Okla.

A NATIONAL sales organization, resources of $1,000,000, established 25 years, having oil field supply offices and warehouses in Kansas City and Tulsa, wants additional lines of unquestionable merit, and of large volume, for distribution to oil producers and industrial plants in Kansas, Oklahoma and Texas. Dun credit rating A+A1. Write Box E-425, The Oil and Gas Journal, Tulsa, Okla.

GAS FRANCHISE effect approximately 240 meters; proven gas acreage near 1,100 ft. Southern Kansas. Box 116, Severy, Kansas.

ATTENTION, INDEPENDENT OPERATORS

Wood County, East Texas, awaits you. Four wells to begin operations at once. Major and independent companies now own 20 blocks throughout the county. Plenty of unleased acreage; good geology. Good banking facilities and co-operation from Chamber of Commerce. Address
CHAMBER OF COMMERCE
Quitman, Tex.

½ Interest in finished well at ¼ cost to date. Shut down with good oil showing. Anderson, Linz Bldg., Dallas, Texas.

BUSINESS OPPORTUNITIES

EAST TEXAS DRILLING BLOCKS. Write or wire me what you want. A. L. Farrell, Grand Saline, Tex.

NEW MEXICO—Abstracts, take-offs, reports on government and state lands; 7 years' experience. H. B. Wright, Las Cruces, N. M.

CURTIS BROKERAGE COMPANY
dealers in
Used Oil Field Equipment
for
Drilling, Production, Gasoline
and Pipe Line Departments.
List your surplus with us.
And advise us of your needs.
S. O. Curtis, P. O. Box 1214,
Seminole, Oklahoma.

DEEDED MINERAL interest spread covers 6 tracts one under 5,000 barrel well in Rusk County new field. Write for map. ¼ mineral rights 142 acres Bee County 1,200 feet from 450 barrel well $250.00 basis. 7,905.5 acres new 10 year paid up lease ¼ royalty same term Edwards County, Texas, in active line of play $1.25 acre. Stieren & Koenig, Alamo National Bldg., San Antonio, Texas.

FOR LEASE—Four tank cars, 10,000 gallons, 50-ton trucks. Have coils. Delivery Chicago. Victor Car Line, 111 West Jackson Blvd., Chicago, Ill.

PATENT ATTORNEYS

REGISTERED PATENT ATTORNEYS
United States and Canada
Before disclosing your invention to anyone, send for blank form.
Evidence of Conception
Bulletin "How to Establish Your Rights" and complete information free.
LANCASTER, ALLWINE & ROMMEL
240 Ouray Bldg. Washington, D. C.

INCORPORATIONS

CHARTERS — Delaware best, quickest, cheapest, most liberal. Free forms. Colonial Charter Co., Wilmington, Del.

RANCHES AND FARM LANDS

10,000 ACRES near Tulsa, Okla. Ideal grazing or dairy, paved road through property; may have oil and gas; has been drilled for shallow production only; will sell on reasonable terms less than agricultural value. Dale S. Johnson, 10 S. Lasalle St., Chicago, Ill.

MONEY RAISING

DO YOU NEED MONEY for organizing or financing oil or mining deals? Write 2443 N. W. 12th, Oklahoma City.

CAPITAL—Call or send facts about high grade oil projects to James E. Miller Co., 207½ East Third St., Tulsa, Okla.

JOHN MORRIS, 3608 WARREN ST., PHILADELPHIA, PA., invites full facts first letter from capable parties planning negotiation of reasonable capital support for undertakings distinctly of higher order. Use registered mail, safeguard data.

FINANCE YOUR OWN project with shares bonded. Quickest, most satisfactory known method of raising capital. Information free. Bankers Interstate Security, Electric Bldg., Denver, Colo.

CORPORATE organizing and promoting of meritorious enterprises; reorganizations and new financing.
The BROOKWORTH CO., INC.
110 East 42nd St., New York, N. Y.

IF YOU WANT your securities or proposition intelligently submitted to underwriting and security selling houses in New York, write W. W. Hines, Room 803, 150 Broadway, New York City.

CAPITAL—An experienced, dependable broker will aid in financing projects of merit. Amster Leonard, East Orange, N. J.

FOR SALE—MAPS

OIL DEVELOPMENT maps, any county in Oklahoma, 75 cents each; lease block and detail maps. Write for map list. Lindsay Map Co., Franklin Bldg., Oklahoma City, Okla.

SOUTHEAST NEW MEXICO
MAPS
Send for list.
THE M. H. HUNTER CO.
Roswell, N. Mex.

POSITIONS WANTED

TECHNICAL SALES EXECUTIVE or MARKET ANALYST. Can build business, effect merchandising economies, handle difficult sales and engineering problems; 10 years' experience as salesman and general sales manager, first rank firm. Engineer. Age 39. Address Box E-418, The Oil and Gas Journal, Tulsa, Okla.

MATERIALS ENGINEER—4 years' experience on refinery and construction materials; pressure stills and inspection work; graduate C. E. and training in metallurgy; any location. Write Box E-429, The Oil and Gas Journal, Tulsa, Okla.

WELDER—Combination gas or electric; experienced pipe line, shop and sheet metal. Can furnish best of reference. J. A. McElrath, Box 366, Sweetwater, Tex.

PIPE LINE construction superintendent, long experience, especially in gas, desires position anywhere U. S. Have operating experience. Now employed. Good hustler, sober. Know costs all types, sizes lines, make up bids, etc. Best references. Age 35. Would be valuable man to new contractor. Write Box E-428, The Oil and Gas Journal, Tulsa, Okla.

GEOLOGIST with much experience in East Texas with major company; excellent reference; desires connection with small company or independent. Part salary, part interest. Write Box E-427, The Oil and Gas Journal, Tulsa, Okla.

POSITION wanted by married man 30 years old. Engineering education. Experienced in buying leases, title work, scouting, right of way buying and claims adjustment; land surveying and pipe line and field construction, good draftsman. Good references. Will go anywhere. Write Box E-423, The Oil and Gas Journal, Tulsa, Okla.

HELP WANTED

JOBBERS AND EXPORTERS
WANTED FOR AUSTRALIA
First quality gasoline, 600 tons monthly with large increases, supplied in drums, cases; approximate specification 61-63 390 E.P. gravity, .725 sulphur freee, antiknock. Also 200 tons lighting and power kerosene monthly, drums, and eight Imperial gallon cases; specifications lighting and power kerosene prime white, smokeless, 41-43; power kerosene 130 test sulphur free, and engine distillate 42-44 470 E.P.; lowest quotations f.o.b. America, c.i.f. Sydney; payment cash against shipping documents; contract 10 years, exclusive rights. Reply by cable. J. Kelso 252 George St., Sydney.

DESIRE connection with producer who would be in a position to furnish 1,500 bbls. of high gravity, Mid-Continent crude per day; also to take financial interest in Canadian refinery. Write Box E-424, The Oil and Gas Journal, Tulsa, Okla.

WANTED

SMALL REFINERY WANTED
500 to 1,000 bbls. capacity; prefer one located in Oklahoma, Texas, and Louisiana, or Arkansas. To be dismantled and shipped. Have location. Write giving location and details. Box E-422, The Oil and Gas Journal, Tulsa, Okla.

RECREATION

ROUGH IT THIS SUMMER at Forest Glenn Ranch near lost lakes in the Rocky Mountains. Riding, hiking, pack trips. The best of trout fishing in lake or stream. Write for rates and make your reservation now. Ask questions. Open July 1. William T. Foreman, Pagoda, Colo.

MOVING PICTURES

EAST TEXAS oil field pictures 8x 10.5 Panoramas and movies for sale. Duffey Mapes, 2223 South Agnew, Oklahoma City, Okla.

EAST TEXAS AND OKLAHOMA City oil field pictures; especially movies. Help sell. Duffey Mapes, 2223 South Agnew, Oklahoma City, Okla.

CLASSIFIED WANTS

Create and Build Sales

LEASES—PRODUCTION

OIL LEASES AND ROYALTIES
Bought and Sold.
In the Hobbs Pool,
Lea County, N. Mex.
A. L. Gurley, Clovis, N. Mex.
P. O. Box 211 Phone 392.

FOR SALE: 5,000 acres oil and gas leases on structure, settled production. Royalties and mineral rights on large tract. Complete data furnished on application. W. P. Harley, Bowling Green, Ky.

MINERAL DEEDS—LEASES
Mineral deeds under major company leases or accompanied by leases. Stevens-Morton County area, Ness-Trego-Gove area in Kansas and Beaver-Texas Counties, Oklahoma area.
J. W. SAIN
310 Brown Building
Wichita, Kansas.

KENTUCKY LEASES FOR SALE CHEAP
Standard form, low rentals, payable quarterly after October 15, 1931; 8,000 acres in Adair County. Near Columbia on big gas dome, 9,000 acres in Russell County, near old oil pools. 4,000 acres in Cumberland County, near old producers, and only 1 mile from "Oil Pool" and pipe line now in operation. Sacrifice prices for quick sale. J. H. Goff, Columbia, Ky.

FOR SALE—Oil leases in proven and semiproven territory in Anderson County, Kansas, shallow field. W. L. Morris Loan Co., Garnett, Kans.

YOUNG COUNTY, TEXAS
For sale: 106 acre new 10 year lease, $1.00 per acre annual rental, good title, abstract furnished for examination. No drilling obligations. $5.00 per acre. Will sell 53 acres for $5.50 per acre. Box 31, Graham, Texas.

EAST Texas Lease blocks and royalties. West Texas royalty $10 down, balance monthly. Anderson, Linz Bldg., Dallas, Texas.

OIL LEASES AND ROYALTIES
In Northeastern Colorado on Morgan uplift. Also drilling blocks geologized by Mr. Culter, who spotted the discovery well.
FREE MAP.
C. T. Ahlstrand
Greeley, Colo.

I HAVE three blocks of oil and gas leases consisting of 30,000 acres with good anticlinal geology in Tioga and adjoining counties, northeast Pennsylvania, where the recent five wells drilled came in ranging from 15,000,000 to 80,000,000 cubic feet; good market and price for gas; will checkerboard any holdings or make drilling proposition on fair basis. P. O. Box 182, Williamsport, Pa.

HAVE 18 checkerboard leases, Van Zandt County, Texas, 56-a to 160-a. Nothing cheap. Address P. O. Box 536, Peoria, Ill.

40-ACRE lease, Lea County, 1 mile from Hobbs Pool, Section 2, Township 19, Range 37 East. Make bid. Address Box 536, Peoria, Ill.

WANT fee land or royalties under major companies' leases in N. M. active areas. Give location and full reports. L. B. Leavitt, 250 Kearny St., San Francisco, Calif.

10,000-ACRE SOLID LEASE BLOCK
New Mexico, Chaves County, near Lea County. Good geology, 6 miles northwest Roswell, five-year term, one-eighth royalty, no drilling required. Five cents acre rental. Price only $1.25 acre. Wm. Spurck, Story Bldg., Los Angeles, Calif.

EAST TEXAS OIL LEASES; drilling blocks, active areas. Write or wire me what you want. A. L. Farrell, Grand Saline, Tex.

EAST TEXAS offerings, Rusk, Gregg, Cass, Marion, Harrison, Upshur leases and royalties. Wire or write your wants. List and maps. Investors, brokers, U.S. and Canada. James R. Haynes, Grantville, Kans.

OIL Crane County bargain, 20 to 160 acres fee by owner, Sec. 18, Blk. 28. 201 Ewell Nalle Bldg., Austin, Texas.

LEASES—PRODUCTION

VALENCIA COUNTY, NEW MEXICO
8—80-acre leases, Section 16
2—80-acre leases, Section 36
$2.50 Per Acre
Address P. O. Box 536, Peoria, Ill.

FOR SALE: Gas and oil leases on 1500 acres in proven gas area, situated in Southeast Kansas. Shale gas at 500 to 550 feet. Part of this is offset acreage to wells gauging more than 100,000 feet. Price $6.00 per acre. W. F. Snively, P. O. Box 184, Mount Hope, Kansas.

ROYALTIES—PRODUCTION

FOR SALE: Lea County, New Mexico, deeded royalty under major oil company leases. Also 5-year oil and gas leases. Small investment. Easy terms. Write for information and map. Monarch Investment Co., Roswell, N. M.

ROYALTIES IN HOT SPOTS, Kansas, Oklahoma and Texas, under drilling wells, offsets, core drilled structures, under Major Co. Blocks, for the small or large buyer. Fast, reliable and dependable service for investors and brokers, in United States and Canada. Special offerings in the Rits high gravity Major pool in McPherson County, Kansas, on Shell Block, under drilling wells, under drilling well Greenwich area Sedgwick County, Kansas, Shell block. Gaines County, Texas, under the Texas Pacific Coal & Oil Co. well now drilling, northeast of Hobbs pool, on 2,503 acres. Many others. Send today for latest list and maps. James R. Haynes, Grantville, Kansas.

ROYALTY BARGAINS in Oklahoma, Lincoln and Pott Counties for sale. American Inv. Co., 201 Elks Bldg., Oklahoma City, Okla.

ROYALTY BARGAINS—Eighteen years practical experience Mid-Continent—now handling distressed royalties—producing and non-producing—desire contact bona fide buyers—bargains. J. B. McAnally, 1118 Hunt Bldg., Tulsa, Okla.

MAKING geological and geophysical survey East Texas, Gregg-Rusk Counties, and further can furnish some royalties and leases; reliable connections solicited; very best of reference furnished. C. E. Deaton, 205 Campbell Bldg., Longview, Texas.

OKLAHOMA OIL ROYALTIES
Royalty Sales Company
Suite 523 105 N. Clark St. Chicago

EAST TEXAS ROYALTIES—Gregg, Rusk, Cass, Marion, Harrison Counties. Big list. Harry Haynes, Grantville, Kans.

ROYALTIES—PRODUCTION

HEADQUARTERS
FOR ROYALTIES

We maintain a complete organization in New York, and in Tulsa (with reliable connections in other oil field centers) for the handling of all kinds of Royalty transactions—buying, selling, investigating.

Your requirements will be given our careful and considerate attention.

We are members of the Mid-Continent Royalty Owner's Association, and we enthusiastically support the Association's code of ethics.

THE LAND & ROYALTY CORPORATION
37th Floor CHANIN TOWER,
NEW YORK

Postal Telegraph Wire in our Office.
Telegraph Address: "CDX NEW YORK"

ROYALTIES—Sure they move slow. Nothing but actual bargains are selling. I'm not wasting my time with anything else. The fellow who makes money is the one who isn't swayed by the crowd. So, for royalties that are selling now write J. B. McAnally, Hunt Bldg., Tulsa, Okla.

J. G. REAVES & COMPANY

Dealing in royalty interests underlying producing oil properties and undeveloped lease-holdings of the major oil companies in all Texas and Louisiana oil fields. Inquiries invited.
Milam Building,
SAN ANTONIO, TEXAS
Reaves Building,
TYLER, TEXAS.

$12.50 BUYS DEED part oil, 2 oil royalties City Pool. Ed Milam, Dept. E, Oklahoma City, Okla.

EAST TEXAS ROYALTIES on geology ahead of production with wildcats drilling close. Sensible prices and individual direct deeds. See maps and geology and pick your own play. Wells drilling make promptness important. R R. Fisk, 1214-C, Wichita Falls, Tex.

FOR SALE—Royalties. Oil and gas leases southwest Kansas; Hugoton gas area; Texas County, Oklahoma. Write P. O. Box 514, Liberal, Kans.

RESULTS

from advertisements carried in the Classified Wants Section are very satisfactory. Letters received from advertisers who use this section prove that this form of advertising pays.

The cost for a ten-line advertisement (one inch) is $3.50 for the first insertion and $2.50 for each additional insertion.

The Oil and Gas Journal
TULSA, OKLA.

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The rate for Classified Display Advertising set in similar style to this Ad or in two Column style is as follows:

1 inch	1 Time	$5.00
1 inch	13 Times	4.50
1 inch	26 Times	4.00
1 inch	52 Times	3.50

One point borders and ten point capitals are allowed, larger type not accepted.

Changes in copy must be in our office 10 days in advance of publication date.

Mail your advertisement to the Largest Classified Section in the Oil Industry.

THE OIL AND GAS JOURNAL
TULSA OKLAHOMA

ROYALTIES—PRODUCTION

BEDROCK ROYALTY PRICES ahead of drilling on major company blocks. $6 per square mile. Perpetual deeds and title warranty. Clearly stated and understandable interests. See maps and bulletins. R. R. Fisk, Box 1214-B, Wichita Falls, Texas.

WRITE ME
For the Right Kind of Producing
OIL ROYALTIES
I Have Them
John L. Dickson, Box 1037, Tulsa, Okla.

$12.50 BUYS DEED PART oil 2 Oil Royalties City Pool. Ed Milam, Dept. Y, Oklahoma City, Okla.

ROYALTIES ahead of drilling wells, major company, core-drilled structures. Write William Hallam, Jr., 214 Patterson Bldg., Denver, Colo.

ROYALTY ON STRUCTURE, vast spread under drilling well now spudding northeast of Rusk, Gregg area, on theoretical shore line, near Sinclair big block Harrison County, East Texas. Between Moncrief Bateman, and Caddo field, being around 15 miles west of Caddo area. Many wells to start in Harrison. Investors, brokers in Canada and U. S. write or wire James R. Haynes, Grantville, Kansas.

GUARANTEED ROYALTIES
FLOYD T. GRISSOM
55 S. Garfield Ave. Pasadena, Calif.

ROYALTY RECORD

Form shows rental record, mortgage record, expenditures, sales record, tax record, well record, monthly production record. All on one sheet; size 8½"x11"; punched to fit standard ring binder. Convenient for desk or brief case. Sheets—$5 per 100; fine leather binder, $5.25; leather tabbed index, $1.20. Order this complete record today. Know what you own and its condition.

E. L. STECK CO.
Austin, Tex.

PANHANDLE NATURAL GAS ROYALTY
162.6 acres, 47,000,000-foot gas well, open flow, to supply city of Indianapolis, Ind. Purchaser assured of long, lasting, paying gas royalty income. Address owner, P. O. Box 825, Tulsa, Okla.

OIL INDUSTRY PRINTING

OIL FIELD LEGAL BLANKS
Leases, assignments, releases, township plat books, well records, etc. Request on your letterhead gets free catalog. Olds Press, 215 East Third St., Tulsa, Okla.

Uncertainty Pervades Eastern Market

Tank Wagon Readjustments Continue, With Refinery Gasoline Situation Less Satisfactory. Other Products Good

By A. E. Mockler
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NEW YORK, Mar. 1.—Readjustment of tank wagon markets in eastern territory received further impetus during the past week with announcement by Standard Oil Co. of New Jersey of a widening in dealers and commercial account discounts to 3 cents per gallon in Maryland. This adjustment was made to meet competition, as was the case during the preceding week in New York and New England, where principal marketers likewise added 1 cent per gallon to their dealers' profit margin. The marketing situation has shown considerable improvement since the turn of the year, and it is indicated that marketers will shortly get back to normal margin spreads in other sections of the East Coast area.

The refinery gasoline situation was less satisfactory during the week, with the permanence of the posted price threatened by price shading in some sections of the territory. The market in general, however, was well held, although an uncertain undertone developed due to the bearish situation in crude oil.

Business in other refined products, with the exception of paraffin wax, was along satisfactory lines. Wax prices weakened, due to competition of distressed resale material, but the remainder of the market appeared to be showing a little more stability, with gallonage running into satisfactory totals.

There was a general exodus of marketing leaders late in the week when executives of the principal interests left for Chicago to attend the marketing conference which will be held in that city this week.

Refinery Gasoline

Recent advances in refinery gasoline prices in East Coast territory have given smaller operators a wider margin to operate on, and as a result price cutting has once again made its appearance in the tank car market. The posted price for U. S. Motor continues at 7½ to 8 cents per gallon, refinery terminals, in the New York harbor district, and this quotation is maintained by all of the principal operators. Some business has been done during the week at 7¼ cents, however, and the larger refiners are watching the situation closely to protect their established outlets.

The Philadelphia market firmed up somewhat during the week, with the action of Vacuum Oil Co. in advancing its tank car price to 7½ cents per gallon at that point, bringing its quotation in line with the general market there.

Boston and the Providence market, where most of the large eastern companies compete, has been a hotbed of competition in tank car sales during the week, and major companies have been compelled to lower their asking prices to meet competition. Atlantic Refining Co., effective February 26, reduced its posted price one-half cent per gallon to 7¼ cents at both points, although other marketers continued to adhere to the higher price. Considerable California gasoline has been going into the Boston territory during the past several weeks, while heavy shipments of South American motor fuel have also reached that area.

The advent of spring weather has centered attention on marine distributing facilities of the major eastern companies, and it is expected that the summer of 1931 will witness a record volume of shipments by river and lake tankers. Practically all of the large companies have gone in for this system of distribution, and recent announcement by Socony of its plans for constructing a gasoline pipe line in New England have led to reports that other large integrated companies are planning distributing revisions along the same line.

Tank Wagon Gasoline

The tendency to broaden dealers' discounts made evident during the preivous week by the action of Standard Oil Co. of New York and other marketers in the New York and New England territory through allowing dealers an additional 1 cent per gallon in their margin was followed on February 25 by Standard Oil Co. of New Jersey, which announced that it had increased its dealer discounts and commercial account discounts 1 cent to 3 cents per gallon in Maryland, to meet local competition. The discount in other parts of the Jersey company's territory remains unchanged at 2 cents per gallon.

There was an appreciable increase in volume in tank wagon markets last week, warm spring weather bringing out a sharp gain in consumption and a corresponding pickup in gallonage for marketers. Tank wagon markets in this territory are now showing a fair degree of uniformity, and the retail price structure is showing more of a tendency to stabilize, although price cutting is by no means out of the picture as yet.

Many of the principal East Coast marketers will be in Chicago this week for the meeting of the marketing division and the board of directors of the American Petroleum Institute, which is gathering to take action on the industry's attitude toward preservation of its code of ethics.

Kerosene

There were no changes last week in either the refinery or the tank wagon markets. The posted price for 41-43 at the refineries continued held at 6½ cents per gallon in tank car lots, with business going through at one-quarter cent under this figure. Tank wagon markets were fairly active throughout the week, with no revisions in posted prices. Eastern marketers are looking for a good spring volume of tank wagon sales this year, and from present indications the season will get under way earlier than usual. Refiners are continuing their efforts to curtail both production and surplus stocks of kerosene in this area.

Fuel Oil

Cuts in fuel oil prices in the Mid-Continent markets have not affected the situation in this territory, and East Coast refiners continue to hold the market for bunker "C" unchanged at $1.05 per barrel in bulk at refinery terminals.

While there was some falling off in the number of fuel oil sales last month, as contrasted with January, 1930, leading sellers report, aggregate gallonage was as good as that for the comparable month last year owing to the fact that a number of the larger steamship lines now have more vessels in operation than at this time in 1930.

The statistical position of the eastern market continues to develop steady improvement, stocks of fuel and gas oils held at refineries in this area declining further during the week ended February 21 to a total of 7,331,000 bbls., as compared with 7,536,000 bbls. on hand at the close of the previous week. Stocks of these oils at East Coast refineries have shown a net decline of 2,270,000 bbls. since the start of the current year, indicating that the industry is adhering closely to its announced plan of reducing refinery holdings to working stock levels.

There is still a little price cutting on industrial sales of fuel oil, but a large part of this business was taken on contract terms at the start of the year, and the spot market is showing a stiffening tendency in line with the firm market for marine sales.

Barring any general lowering in posted prices for crude oils, refiners in this area look for steady improvement in the position of the fuel oil market, with the possibility of a better return on sales of this oil later on in the year.

Diesel Oil

Slow recovery in shipping operations is being paralleled by a moderate increase in Diesel oil sales, and volume thus far in the year has kept abreast of that for the comparable period of 1930. The market remains steady and unchanged at $1.85 per barrel in bulk at refinery terminals, plus the usual charge of 6½ cents per barrel for barging alongside within the harbor limits.

While detailed figures on Diesel oil stocks in this area are not available, it is reliably reported that the market is in a favorable position from this standpoint, and this, together with the steady increase in marine consumption as new vessels come into service, is expected to make for a satisfactory market this year with total gallonage for 1931 expected to show a modest increase over 1930 sales totals.

Gas Oils

Industrial consumption of gas oil has been well maintained in the local area during the past week, and the market is without quotable alteration. The posted price for 28 plus recycled gas oil is still 5¼ cents per gallon in tank car lots at refineries, with actual business consummated all the way from 4¼ cents up to the posted level.

Gas oil holdings in East Coast territory are substantially smaller than at the start of the year, and refiners are making every effort to further reduce their surplus holdings. Weakness in gas oil prices at the Gulf is tending to make for an easy tone here, but it is not considered likely that much gas oil will find its way into this territory from either the Gulf or California at current prices.

Lubs

Spring demand for cylinder oils is beginning to make its appearance, and current price levels at the refineries appear attractive to buyers. There was a fair inquiry from domestic consumers this week, and a moderate amount of business for prompt and nearby shipment was closed. Bright stocks are coming in for more attention, and while nothing in the form of any sensational price advance is looked for, operators believe that the general market for cylinder oils will show some appreciation as spring and summer buying picks up.

The export market for lub oils is still in somewhat unsettled position, and there is little actual buying in the market. Foreign distributors have been carrying light stocks during the past several months, and show no tendency at the moment to add substantially to their inventories, although a seasonal increase in demand is looked for within the next few months.

Industrial demand for red and pale oils is well maintained, and the market is steady and unchanged at quoted levels.

Petrolatum

Fractional recessions in quotations for amber petrolatums are reported this week, but with this exception the market continues in steady position, with a fair movement reported.

Another petrolatum on spot is available at 3 cents per gallon, one-quarter cent under the previous quotation, while the market for extra amber is quoted off an eighth cent per pound at 3¼ cents.

Export inquiry for the lower grades continues fairly active, sellers report.

Paraffin Wax

Falling off in new buisness this week was reflected by a further easing off in the position of the spot market, although refiners continue to show rather firm price views. Spot 120-122 a.m.p. is an eighth lower at 3 cents per pound, with corresponding declines shown on 125-127 a.m.p. at 3⅜ cents and 130-132 a.m.p. at 3⅝ cents per pound. Stocks of 135-137 a.m.p. fully refined are scant and the market holds firm at 4¾ cents per pound.

Crude scale has weakened, with business reported closed in 122-124 a.m.p. this week at 2.20 cents per pound, 5 to 10 points under previously existing quotations.

An explanation for the relative weakness in the spot market, as contrasted with the firm views of the refiners, is seen in the fact that a good deal of the recent business has been taken by interests which were "long" in the market and which have been willing to resell at a loss in order to liquidate their positions. This distressed wax is now believed to be pretty well cleaned up, however.

Domestic paper manufacturers are expected back in the market within the next few weeks to place contracts for their requirements during the second half of the year, and other domestic manufacturing consumers, who have not bought in their usual volume thus far in the year, are also expected to re-enter the market in the near future.

Export business, which was fairly good during January and the first half of February, showed a material falling off during the closing half of the month just ended.

Furnace Oil

Milder weather has been accompanied by a slight falling off in the demand for furnace oil during the past week, but prices for the various grades continue unchanged.

Jobbers are not operating in the tank car market for furnace oil in a large way, and with the close of the season in sight, these distributors in most instances are content to let their storage stocks dwindle and to come into the market for replenishment stocks only as the oil is required for delivery on actual orders.

Export Market

With Rumania still underselling American refiners by a substantial margin, continued quiet in Gulf gasoline markets was reported last week. A statement issued by Asiatic Petroleum here this week dealing with the Rumanian situation says in part: "The price given for Rumanian gasoline at Port Constanza is the equivalent of 2 cents a gallon ex-refinery Oklahoma." The Asiatic statement indicated that there is still considerable distressed Rumanian gasoline to be liquidated, giving present stocks of gasoline in storage in Rumania as 2,064,000 bbls., as compared with approximately 1,131,000 bbls. on hand at this time last year.

A further cause for dullness in the export market at the Gulf last week was a report which gained wide circulation in export circles indicating that a substantial reduction in Gulf export gasoline quotations would be forthcoming within the next few days.

Gulf kerosene markets were also quiet during the week, reflecting continued keen competition from Russian and Rumanian kerosene in European markets.

No trading was reported in either Mexican or Venezuelan crudes during the week, although some interest was shown in the Venezuelan product and it was considered likely that some business would be closed within the next month or so, buyers holding off in anticipation of a reduction on United States crudes, and a corresponding mark-down on the Venezuelan product.

Petroleum Exports

Export movement of refined petroleum products from New York failed to show any improvement during the week ended February 21, further falling-off in shipments being reported on most products. Uncertainty regarding the stability of the crude oil market was in some measure responsible for the lack of demand, opera-

tors reported, while the stronger spot markets for refined products, in the face of the unsettled crude markets, likewise tended to restrict export inquiry for the time being.

The following table shows principal exports of refined petroleum products from New York for the past three weeks (all figures in gallons unless otherwise noted):

	Week ended		
	Feb. 21	Feb. 14	Feb. 7
Gasoline	200,000	215,000	615,000
Naphtha	90,000	160,000	768,000
Kerosene	40,000	185,000	100,000
Fuel oil		535,000	56,000
Lubricating oil	1,150,000	1,600,000	1,610,000
Petroleum, ref.	900,000	225,000	1,550,000
	Pounds		
Petrolatum	6,000		115,000
Paraffin wax	1,070,000	245,000	1,590,000
Refined	140,000		630,000
Scale	280,000	150,000	1,195,000
Lubricating grease	695,000	960,000	1,425,000

Reports from European markets indicate that buyers of American refined products are down to an extreme hand-to-mouth basis of operations, and that these distributors are carrying very light reserve holdings. No pronounced buying movement for the replenishment of inventories is in sight for the immediate future, however, unless the American market should show unmistakable signs of a pronounced upswing in prices. Consumption of American refined products in European and other export markets is suffering from continued sharp competition afforded by Russian and Rumanian refined products, the latter particularly having sold recently at quotations substantially under price levels for comparable American products.

Imports

Imports of crude and refined petroleum at the principal United States ports for the week ended February 21 totaled 1,405,000 bbls., a daily average of 200,714 bbls., compared with 1,447,000 bbls., a daily average of 206,714 bbls. for the previous week and a daily average of 236,250 bbls. for the four weeks ended February 21. Details follow:

	Bbls. of 42 gals
At Atlantic Coast ports—	
Boston	290,000
New York	688,000
Philadelphia	155,000
Others	187,000
Total	1,320,000
Daily average	188,571
At Gulf Coast ports—	
New Orleans and Baton Rouge	70,000
Tampa	15,000
Total	85,000
Daily average	12,143
At Atlantic and Gulf Coast ports—	
Total	1,405,000
Daily average	200,714
Daily average four weeks	236,250

Distribution of total imports is as follows:

Crude	819,000
Gasoline	159,000
Fuel oil	427,000

California Oil Receipts

Receipts of California crude and refined petroleum at Atlantic and Gulf Coast ports for the week ended February 21 totaled 444,000 bbls., a daily average of 63,428 bbls., compared with 245,000 bbls., a daily average of 35,000 bbls. for the previous week, and a daily average of 57,643 bbls. for the four weeks ended February 21. Details follow:

	Bbls. of 42 gals.
At Atlantic Coast ports—	
Baltimore	116,000
New York	219,000
Others	34,000
Total	369,000
Daily average	52,714
At Gulf Coast ports—	
Total	75,000
Daily average	10,714
At Atlantic and Gulf Coast ports—	
Total	444,000
Daily average	63,428
Daily average four weeks	57,643

Distribution of total California oil receipts is as follows:

Gasoline	311,000
Kerosene	47,000
Gas oil	75,000
Lubricants	11,000

Shipments of California refined products eastward during the week (with identity of owner of tanker moving the oil where such owner is an oil company) follow:

To New York—114,700 bbls. of gasoline on the Tide Water (Tide Water Oil Co.); 146,100 bbls. of gasoline on the Australia; and 113,700 bbls. of gasoline on the Western Sun (Sun Oil Co.).

To Norfolk, Va.—72,000 bbls. of gasoline on the New Jersey (The Texas Company).

To Philadelphia—56,000 bbls. of gasoline on the Arizona.

Charter Market

"Black Sea shippers continue to be fairly active in various directions and are open for further tonnage to cover their requirements to Continental and United Kingdom ports," says Funch, Edye & Co., Inc., in their weekly review of the tanker market. "Transatlantic inquiry for clean vessels is limited and only one order is quoted on this market for a small cargo, March loading. Black oil tonnage is still required Gulf/transatlantic April/May and creosote carriers can be placed for similar position. Foreign time-charterers took two vessels for short periods clean and dirty trades. All branches of the market, however, are exceptionally quiet and rates abnormally low. One or two fixtures are reported in the American coastwise and intercoastal trades, but these markets continue quiet with little demand."

Fixtures during the week were as follows:

Am Stmr Manatawny, 7,565 d.w., dirty, Gulf to North Hatteras, 14c, prompt, 6,000 tons d.w.

Am Stmr Pueblo, clean, 6,000 tons d.w., Gulf to North Hatteras, 18c, prompt.

Nor Stmr Storsten, 8,000 tons d.w., clean, Constanza to U.K./Continent, 7/-, March.

Fr Stmr Hyrcania, 7,570 tons d.w., clean, six months time charter to Spanish Monopoly, 3/9, prompt.

Nor M/S Solstad, 8,170 tons d.w., clean, Constanza to South Spain, 6/6, option North Spain 7/6, March.

Fr Stmr Nausicaa, 7,869 tons d.w., clean, Black Sea to Arzew and Port de Bouc 7/-, March.

Nor M/S Norfold (or Norvinn), 10,000 tons d.w., dirty, time charter, 5/8 months, delivery April/May, about 5/-.

Stmr (Kurz boat), clean, one year, Gulf to North Hatteras, 18½c minimum, option California loading 55c.

Ger Stmr Emmy Friederich, 6,300 tons d.w., vegetable oil, Black Sea to U.K./Continent, 11/3, March.

Nor M/V Bisca, clean, 8,000 tons—10 per cent, Black Sea to Vladivostok 17/6, March.

CANADIAN FIELDS

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berta, the test of outstanding interest is Alberta Pacific Consolidated's No. 1, Section 15-4-23w4, on the Spring Coulee structure. This test was last reported drilling at 5,553 feet and working in a black shale somewhat softer than the formations previously penetrated. There is considerable water, and heavy mud is used to control it. Production was originally looked for in the Sunburst sand around 5,500 feet, but this horizon has not been reached. It is reported contract has been arranged with the Sheldon-Burden Co. for considerable additional depth and the test may be carried to 6,000 feet.

To Deepen Taber Test

Alberta Pacific Consolidated Oils, Ltd., of Calgary has taken over and will complete the test drilled last year in the Taber area by the Cole-English Syndicate. This test was located by Campbell Hunter, the British geologist, in LSD 3, Section 11-10-17w4, and is a considerable distance east and north of the Spring Coulee test. The test was carried to 3,320 feet and got about 2 feet into what looked like a fairly promising oil sand when the rotary tools were lost; and after fishing some time were left in the hole when work was shut down toward the latter part of last summer. The Cole-English Syndicate and associate interests increased their original extensive holdings in the Taber district as the well went down; and all this acreage is being taken over by the Alberta Pacific Consolidated. George W. Scott, general manager of the latter company, recently made an inspection of the well and acreage, and is reported preparing to fish the lost tools.

Hudson's Bay Test

In the Keho Lake area, Hudson's Bay Oil & Gas Co.'s No. 1 Keho, LSD 2, Section 17-11-22w4, is reported drilling out cement after setting 13⅜-inch casing at 3,053 feet.

In the Castor area, Hudson's Bay's No. 1 Paintearth, LSD 5, Section 27-39-15w4, is reported standing cemented at 3,628 feet.

Ribstone Field

In the Ribstone Field, East Central Alberta, Algonquin Petroleums' No. 1 LSD 1, Section 20-45-1w4, has resumed drilling from 2,105 feet. In the Meridian wells, production was encountered in a sand at 1,950 feet. Algonquin's No. 1 is reported to have got a little gas above this horizon, but the oil sand was not encountered, and drilling is being continued in hope of picking up another oil-bearing horizon before the lime is struck. Geologists place the top of the lime around 2,200 feet. The test is being drilled jointly by Algonquin Petroleums, Ltd., and Commonwealth Petroleums, Ltd. The Meridian wells, which got a good production of heavy crude at around 1,900 to 1,950 feet, are less than a mile south of Algonquin's No. 1, the latter being somewhat higher on structure. Rayco Oils' No. 1, LSD 3, Section 4-47-1w4, has spudded in and drilling below 50 feet.

Alberta Staffs Reorganized

Following the transfer to the province of Alberta last October of the natural resources, previously under control of the federal government, a reorganization has been effected of the former federal staff. The new provincial supervisory staff will be located in the three principal cities of Edmonton, Calgary and Lethbridge. The Edmonton office will be in charge of William Calder, gas and petroleum engineer, assisted by F. K. Beach, R. M. S. Owen and A. MacRae. The Calgary staff will include C. W. Dingman and V. Taylor. G. R. Elliott, who has been looking after work in the southern part of the province, will be in charge at Lethbridge. Operating under the general supervision of Dr. C. C. Ross, the federal supervisory mining engineer's office at Calgary will henceforth be looked after by F. M. Steele, his staff including A. J. Goodman, petroleum geologist; W. P. Campbell, chemist; and Miss Kay.

Canadians in Pennsylvania

Homestead Oil & Gas Co., an enterprise with office at Toronto, Ontario, has secured 50 leases totaling 5,000 acres in the Tioga, Pensylvania, fields. These leases were acquired over a period of several months by W. E. Hurd, and one of the principal blocks is stated to be within 150 feet of the Penn-United Gas Co.'s Ben Meeker gasser, which recently blew in with a reputed open flow of 4,000,000 feet an hour. It is understood Homestead Oil & Gas Co. is preparing to drill on its acreage close to the Meeker well.

Ontario Drilling

In the Dawn Field, Lambton County, Ontario, Union Natural Gas Co.'s No. 55 Stinson farm, Lot 15, Concession 3, is reported drilling at 1,675 feet without a show. Union's No. 56 Christner farm, Lot 22, Concession 10, is drilling around 550 feet.

In Kent County, Argo Oil & Gas Co.'s No. 2, Lot 2, Concession A, Raleigh Township, near Fletcher, is drilling. Farther south and east in the D'Clute Field, American Engineering Co.'s No. 4 Simpson farm, Lot 148, South Talbot Road, Raleigh Township, is drilling around 400 feet.

In Mosa Township, Middlesex County, Southern Ontario Gas Co.'s No. 7, SW, Lot 14, Concession 3, is drilling.

LA.-ARK. FIELDS

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3,568 feet, but was junked and abandoned without making a test. The W. G. Ray Drilling Co.'s No. 1 Hall, D. Davis Survey, Harrison County wildcat, began operations on February 20, and is drilling below 1,100 feet. Sam E. Bell and others' No. 1 Burnett Lumber Co., S. B. Hendricks Survey, Panola County, which has been shut down, has resumed operations and is drilling at 3,180 feet.

Leasing continues active in Cass, Marion, Harrison, Panola and Shelby Counties, Texas, with numerous blocks being assembled, principally by individuals and on neighborhood drilling contracts with major companies securing checkerboard acreage as well as blocks, and it appears that the above counties will receive an intensive wildcat drilling play.

A decrease of 1,725 bbls. in daily average runs from Zwolle and decreases of 100 bbls. from Holly and 125 bbls. from Caddo light, together with small declines in other North Louisiana pools, accounted for a net decline in North Louisiana runs of 2,065 bbls. Small increases in Arkansas pools cut the net decline from the division as a whole to 1,850 bbls. Total runs averaged 92,870 bbls., of which North Louisiana contributed 42,815 bbls. and Arkansas 50,055 bbls. Daily average runs from the several pools were:

NORTH LOUISIANA	
Caddo, light	8,080
Caddo, heavy	2,850
Homer	3,365
Haynesville	5,585
DeSoto-Red River	2,725
Elm Grove	430
Bellevue	585
Cotton Valley	1,825
Urania	4,885
Pleasant Hill	470
Sarepta-Carterville	1,665
Zwolle	9,725
Holly	625
Total	42,815
Last week	44,880
Decrease	2,065
ARKANSAS	
El Dorado	3,850
Smackover, light	4,430
Smackover, heavy	33,500
Stephens	850
Nevada	1,000
Lisbon	780
Champagnolle	4,560
Bradley	65
Mount Holly	60
Urbana	960
Total	50,055
Last week	49,840
Increase	215
Both states	92,870
Last week	94,720
Decrease	1,850

CALIFORNIA FIELDS

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of the week. This project is located west of the General Petroleum's well No. 2 on Needham tideland No. 55, which is at present rotating ahead in a gray sand at 2,280 feet. In the Elwood Field of Santa Barbara County the Barnsdall and Rio Grande are making satisfactory progress with No. 14 Bell Luton, a deep Sespe test in the eastern part of the field. This well shows evidence of resulting in commercial production, although this will not be definitely determined for at least another few weeks. These operators are also drilling a Sespe test on the Bishop-Evans property in the eastern part of the field. The Irvine Oil Co. has not yet drilled out the cement in No. 1 Lowe, a potential producer in the Santa Barbara Mesa Field. The Prairie Oil Co. topped the Vaqueros in its No. 1 Capitan east of the Capitan Field of Santa Barbara County at 2,779 feet and found it barren. The company will continue work in the hope of developing commercial production in the underlying Sespe. The Bolsa Chica is still working on its tideland wildcat at Coal Oil Point, located about 4 miles east of the Elwood Field, but the status of this hole is such that the development of commercial production in this hole is rather dubious.

SEEKING BROTHER

B. Baxter of 1325 East Fourth Street, Pueblo, Colo., is seeking information about a brother, Michael Baxter, aged 44, height 5 feet 10 inches, weight probably about 155 pounds, dark complexion, black or dark gray hair, blue eyes. Worked for Sinclair Oil Co. at Casper, Wyo., in 1927 as fireman, and in Texas oil fields, and on pipe line at Rawlins.

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Brief Items for Petroleum Refiners

NEBRASKA INDEPENDENTS COMBAT CITY OWNERSHIP

LINCOLN, Neb., Mar. 3.—Three hundred Nebraska oil jobbers assembled in the state capitol Thursday afternoon to attend an open hearing on House Bill No. 329, which permitted all towns and villages to engage in the gasoline and oil business, wholesale and retail, at cost plus certain contingencies.

This bill was the direct result of a recommendation in Gov. Charles W. Bryan's inaugural message and was introduced by a farm member, A. J. McCoy of Dawes County. J. R. Farris, Governor Bryan's purchasing agent, who operated for 18 months the Lincoln municipal station, the only one of its kind in the country, appeared as a speaker in behalf of the bill. Ten selected speakers representing the independent oil men were introduced by Charles M. Sutherland, secretary of the Nebraska Oil Men's Association, in opposition to the bill.

After the hearing the cities and towns committee went into executive session and indefinitely postponed the bill. Since this is the governor's measure, an effort may be made to raise it on the floor of the house, but there is not much evidence at present that this will be successful.

FRENCH IMPORTS SHOW GAIN IN OIL MARKETS

NEW YORK, Mar. 2.—Imports of crude petroleum and refined products into France during 1930 aggregated 3,524,976 metric tons, valued at 2,910,000,000 francs, an increase of 487,808 tons over the 1929 imports of 3,037,168 tons.

Imports, by products, were as follows:

	Metric tons 1930	Metric tons 1929
Crude petroleum	451,902	23,390
Kerosene	190,521	237,004
Motor spirit	1,873,296	1,675,626
Lubricating oil	276,426	280,243
Gas oil	153,251	165,363
Fuel oil	465,539	499,121
Road oil, etc.	80,011	116,892

Persia and Venezuela accounted for the bulk of crude petroleum shipments into France last year, each country supplying 45 per cent of the year's total. The United States led in the supply of kerosene, gasoline and lubricating oils, supplying 63 per cent, 55 per cent and 77 per cent, respectively, of these products.

GASOLINE DECLINES ABROAD

NEW YORK, Mar. 3.—Effective today, principal marketing companies in Great Britain, including Anglo American and Shell Petroleum, will reduce gasoline 2 pence (4 cents) per gallon to the equivalent of 29 cents per gallon. Soviet gasoline, which had previously been underselling other motor fuel in the British market, was also cut 4 cents per gallon in England today. No further changes in the local tank car market developed today and it appears now that a determined effort will be made to hold the market at present levels.

NEW MARKETING ORGANIZATION

Penn-O-Tex Oil Co. of Minneapolis, Minn., has opened a general marketing organization to cover the northwest territory. F. M. Starling is president of the company which has headquarters in the Plymouth Building.

ADDING ROAD OIL UNIT

Work has started on the construction of units to manufacture road oil and petrolatum at the Kettleman Gasoline Co. refinery at Hanford, Calif. Road oil production will be 150 bbls. a day.

PEERLESS OIL REFINERY IS BOUGHT BY ALTITUDE

Altitude Petroleum Corp. announces the purchase of the Peerless Oil & Refining Co.'s 5,000-bbl. skimming plant and cracking units of the Jenkins type at Chanute, Kans. E. E. Roper, formerly sales manager of Miller Petroleum Co., is sales manager.

The Altitude company will purchase stripper crude in Kansas, as well as oils from Oklahoma City and the Texas fields. The company is planning to consolidate the interests it has in other refineries to operate under one name.

PRAIRIE RETAINS A. W. LONG

Prairie Oil & Gas Co. has installed A. T. Smith of its Independence offices as vice president and general manager of the Long Oil Co., of which they recently obtained control, and A. W. Long continues as president of the company. The board of directors was entirely changed with two exceptions, Mr. Long and W. D. Wormer of Manhattan. P. C. Spencer and R. G. Emo of the Prairie company were placed on the board.

BURFORD, EAST TEXAS MERGE

Offices of Burford Oil Co. and East Texas Refining Co. have been consolidated and moved to Dallas, Tex. The Burford company offices were in Tulsa, and those of East Texas company were located at Henderson, Tex. The changes were completed March 2.

SHUT DOWN ITALO PLANT MODERNIZED BY EXETER

Exeter Oil Co. of California, which recently sold its subsidiary, United States Refining Co., to Signal Oil & Gas Co., has awarded a contract to C. F. Braun & Co. for the construction of a fractionating tower at the old Italo Oil Co. skimming plant at Hines, which it has purchased. The modernized plant is expected to be in operation in April, producing gasoline and side cuts of light distillate, gas oil and fuel oil.

EAST TEXAS OPERATORS ACTIVE

Constantin Refining Co. is planning to build a refinery at Tyler, Tex. This is a 5,000-bbl. skimming plant, and will process crude oil from the Joiner Field. A contract for 1,000,000 bbls. of this East Texas oil is reported closed by Consolidated Oil Co. with Crown Central Petroleum Co. as buyer. The amount involved is given as approximately $500,000.

MAY BUILD REFINERY

J. P. Gillen, former vice president of the Deepwater Oil Refineries, Inc., Houston, Tex., is contemplating the construction of a 2,500-bbl. skimming plant near the Joiner Field in Rusk County. The plant will process crude from this field, and probably take oil from the Inland Waterways Pipe Line Co.'s 4-inch line which runs from the field to a loading rack on the I.&G.N. Railroad, approximately 3 miles north of the field.

CALIFORNIA PRICE WAR SHARED BY ALL MAJORS

LOS ANGELES, Calif., Mar. 2.—California is in the throes of another one of its regular periodic gasoline price wars, the present battle being precipitated late last week when the Standard Oil Co. sliced off 2 cents per gallon and followed this up by cutting off another 4 cents on Saturday, February 28. This reduction of 6 cents per gallon in less than four days' time brought the retail price in southern California down from 20½ cents to 14½ cents per gallon, including the state road tax of 3 cents per gallon. It is the present opinion of marketers that the bottom has not yet been reached by any means although these price wars usually end abruptly and may do so again this time.

The Standard company's reduction is attributed to a substantial loss of gallonage due to bootlegging and cut rate prices established by jobbers who have been working the tank wagon racket overtime. The situation has been further aggravated by a tendency on the part of certain major refiners to take the edge wherever possible by shading prices and furnishing jobbers with tank wagon loads of gasoline below prevailing wholesale prices. This has created a condition of unrest and is expected to result in further drastic reductions.

All major companies, comprising Union, Shell, General Petroleum, Richfield, Associated and The Texas Company, met both of the Standard's cuts immediately. Bootleggers and distributors of cut rate gasoline have dropped prices to 10, 11 and 12 cents per gallon and are making preparations to effect further reductions if major companies post any additional cuts. So far price cutting has been limited to California but will extend up into Washington and Oregon if the war in California continues for any length of time. In the San Francisco Bay region prices have not yet been cut to the same extent as in southern California where the battle is heaviest. Advices from Sacramento, the state capital, indicate that Assemblyman Jesperson of Paso Robles will introduce a resolution in the state legislature asking for a general inquiry.

PURE OIL COMPANY'S NEW TOLEDO REFINERY BUILT IN FIVE MONTHS

Only five months were consumed in the construction of the Pure Oil Co.'s new 8,000-bbl. refinery at Toledo, Ohio, a record of which the company's engineers are proud. The construction work included building three combination Gyro units, rerun unit, gas recovery system and a continuous treater. Ground was broken on September 1, 1930, and the plant was ready for operation February 1 of this year.

Crude will be supplied the plant from the Mid-Continent through the Ajax pipe line and also by barge from the Mount Pleasant, Michigan, fields. The first shipment of Mid-Continent crude by pipe line was made a little over a week ago when 50,000 bbls. of Oklahoma oil were delivered by the Pure Oil Co. to the pipe line destined for the new Toledo refinery.

In addition to the operating equipment, the construction program included building storage for 600,000 bbls. of crude and finished oils. The company will manufacture gasoline, kerosene and heavy industrial fuel oils at the new plant.

Picture of Pure Oil Co.'s new Toledo refinery taken January 20. The plant has since been placed in operation. The three Gyro units may be seen in the left half of the picture.

MORE ACTIVITY AMONG REFINERS IN KENTUCKY

Simrall Refining Corp. is completing a 1,000-bbl. skimming plant at Horse Cave, Ky., and work is expected to start soon on a pipe line from the LeGrande Field to the refinery. The company will also sell crude oil from this line on the market.

Stoll Oil Refining Co. of Louisville is building two 10,000-bbl. tanks and a pumping station which will be connected through a 4-inch line to the Louisville refinery. Producers Pipe Line Co. is planning a 4-inch line from the Legrande Field to tanks they are building at Horse Cave to supply the Louisville Refinery Co. Another line from the Legrande Field will carry gas to the city gates of Nashville, Tenn., for the Kentucky Natural Gas Co. A contract has been let by Oil Operators, Inc., for the construction for a 4-inch line to run from this field to Rowlets.

CENTRAL TEXAS PLANT SOLD

Sale of Central Texas Refining Co., Minerva, Tex., to G. C. Kent of Corsicana, together with its pipe line system, has been announced by R. L. Wheelock, who has been manager in receivership of the company. The skimming plant will be operated by Kent-Middleton Co.

Manufacture of Natural Gasoline

Natural Gasoline Prices Now Follow General Price Trend

The interdependency of natural gasoline prices and refinery motor fuel prices is thoroughly recognized and is graphically shown in the accompanying chart. It will be noted that this correlation has been closely observed since May of 1929. Where the ratio is seen to be disturbed most there follows an almost immediate recovery of one or the other products restoring the apparent equilibrium of prices.

Looking over the situation in 1927, natural gasoline held a higher price average than U. S. Motor fuel during two months, and fell as much as 2 cents below the refinery markets for a period of three months. During the rest of the year U. S. Motor held a fraction of a cent advantage. In 1928, we find the natural gasoline price moving above the refinery figure throughout July and August, and at three short intervals in September, October and November, although the U. S. Motor price shows a better average price.

During the four months preceding May in 1929, natural gasoline advanced above the refinery market at two points, dropping below about the middle of May. Since that time U. S. Motor fuel prices have remained well above the natural gasoline postings.

The refiners, as customers, are largely responsible for the price relationship which is observed. Most of these operators have found it expedient to curtail their purchases of natural gasoline for blending purposes when the price of this commodity gives them a disadvantage in respect to refiners who rely upon the modern facilities at their own plants for a comparable grade of motor fuel.

The advances of refinery engineering during the past few years have placed in the hands of the refiners the means of meeting competitive conditions which would have been fatal at earlier periods. However, it must be kept in mind that other factors are operating to hold the price of natural gasoline below the refinery markets. Obviously the refinery will not purchase natural gasoline to produce a blended fuel which is cheaper. Especially when transportation charges on the natural gasoline may be as much as 2½ cents a gallon. Nor will the refiner buy natural gasoline, at any price, if he cannot move his own product.

UNITED STATES MANUFACTURES 90 PER CENT WORLD'S NATURAL GASOLINE

The world production of natural gasoline increased from 41,470,069 bbls. in 1927 to 58,200,357 bbls. in 1929, a gain of 16,730,288 bbls., or 40 per cent, according to the Department of Commerce, following the completion of a survey conducted by E. B. Swanson, chief petroleum economist.

During the period covered by the survey, United States production accounted for more than 90 per cent of the world total, but the output of foreign plants formed an increasing proportion of the total, advancing from 5.8 per cent of the total in 1927 to 8.6 per cent in 1929. The relative proportions of domestic and foreign production of natural gasoline are shown in the accompanying table.

Of the 1929 production of 5,017,309 bbls. reported for foreign countries, approximately 2,000,000 bbls. were mixed with crude and transported from producing properties, the quantity of natural gasoline production being included in the figures of crude oil production, while the remaining quantity was transported separately, either by pipe line, tanker or tank car, to refineries for blending with naphthas in the production of motor fuel Aside from the United States, natural gasoline production was reported for 16 countries, Netherland East Indies, Peru, Persia, Rumania, Russia (U.S. S.R.), Poland, Colombia, Venezuela, Argentina, British India, Japan and Taiwan, British Borneo, Egypt, Mexico and Trinidad. A limited production was reported for Canada in 1927 and 1928, but none for 1929. Among the countries to which inquiries were sent and which reported that no natural gasoline was being produced were Brazil, Czechoslovakia, Ecuador, Estonia, France, Germany and Italy. It was reported also that a small quantity of natural gasoline had been produced in Australia, but not to the extent of a commercial operation.

Of the production reported for Netherland East Indies during 1929, approximately 600,000 bbls. were mixed with crude and the balance transported to refineries for blending in the production of motor fuel. All of the production reported for Peru was transported by pipe line to Talara for blending with the gasoline produced at the refinery. Of the 1929 output of 726,190 bbls., 643,214 bbls. was reported as the production of gasoline plants at La Brea and Parinas and 82,976 bbls. from Lobitos. All of the Persian production is blended with crude in the field and transported by pipe line to the Abadan refinery, the natural gasoline being included in the annual reports of crude oil production. In Rumania, Russia and Poland natural gasoline is handled almost entirely apart from crude oil

(Continued on Page 196)

DOMESTIC AND FOREIGN PRODUCTION OF NATURAL GASOLINE

	1927		1928		1929	
	Barrels	Per cent	Barrels	Per cent	Barrels	Per cent
United States	39,074,857	94.2	43,191,286	91.9	53,183,048	91.4
Foreign	2,395,212	5.8	3,832,265	8.1	5,017,309	8.6
Total	41,470,069	100.0	47,023,551	100.0	58,200,357	100.0

WORLD PRODUCTION OF NATURAL GASOLINE, 1927-1929

(Figures in barrels of 42 gallons each)

Country—	1927	1928	1929
United States	39,074,857	43,191,286	53,183,048
Netherland East Indies	779,143	1,062,160	1,333,926
Peru	415,555	641,424	726,190
Persia	190,105	460,305	696,730
Rumania	167,000	286,000	476,000
Russia	185,800	232,000	361,000
Poland	263,948	302,623	327,798
Colombia	77,505	244,850	329,358
Venezuela	83,530	250,914	311,764
Argentina	20,974	83,372	142,311
India, British	79,704	104,797	99,888
Japan	67,798	67,492	77,324
British Borneo (Sarawak)	22,678	48,732	76,235
Egypt	16,855	21,498	21,162
Mexico	13,461	12,886	18,759
Taiwan (Formosa)	5,026	13,036	15,000
Trinidad	.....	.....	3,864
Canada	6,140	176	.....
Total	41,470,069	47,023,551	58,200,357

Suggest That Waste Gas Be Utilized In Alcohol Production

CHATHAM, Ontario, Mar. 2. — Solution in part of the problem of finding uses for the waste reserve gas in the Turner Valley Field is a possibility as a result of a process for the manufacture of industrial alcohol that has been developed in the Ottawa laboratories of the National Research Council.

If applied only to the so-called stabilizer gases (the gases which are collected at the well heads along with the crude naphtha but later are allowed to escape into the atmosphere) the process, it is estimated by Dr. G. S. Whitby, director of the division of chemistry, could yield industrial alcohol to the extent of 10,000,000 gallons a year.

If applied to the total waste of gases in the field, the figure would be 140,000,000 gallons. Immediate prospects of alcohol production at an economical cost are considered better for the former than for the latter, since the stabilizer gas is already under some form of control and hence more readily available.

According to available statistics, industrial alcohol is in increasing demand. While the British have been turning to a study of coal in their efforts to make themselves independent of outside sources

(Continued on Page 200)

DEVONIAN PLANT ENLARGED

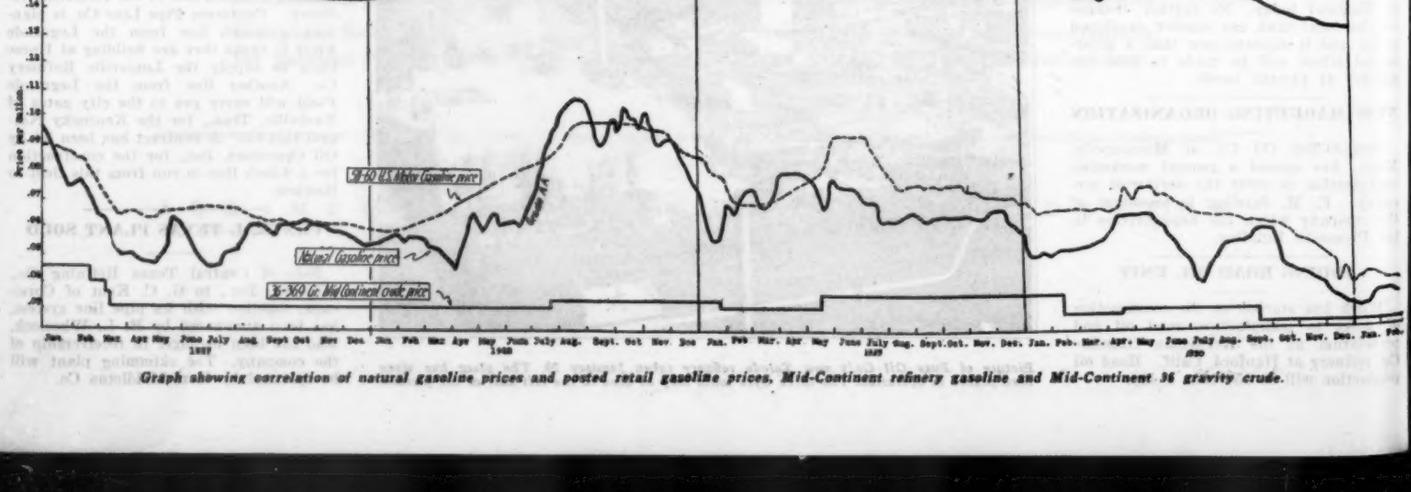
Devonian Oil Co. is increasing the working pressure of its natural gasoline plant at Kellyville, Okla. A 200-horsepower Clark engine has been added to the plant and a 73-horsepower boiler has been replaced with an 80-horsepower boiler

EASON TO BUILD PLANT

Eason Oil Co. of Enid is building a natural gasoline plant on its producing lease south of the Crescent Field and a few miles west of Guthrie, Okla. Twin Clark units of 200 horsepower are being installed.

MARATHON SELLS MORRIS PLANT

Marathon Oil Co. has sold its natural gasoline plant at Morris, Okla., to Powers & Quinlan Gasoline Co. Another Oklahoma plant of the Marathon company at Haskell has been shut down.



Graph showing correlation of natural gasoline prices and posted retail gasoline prices, Mid-Continent refinery gasoline and Mid-Continent 36 gravity crude.

Kansas Legislators Hear Pros and Cons At Proration Hearing

TOPEKA, Kans., Mar. 3.—Representatives of the oil industry in Kansas were divided today on a proposal before the state legislature for enactment of a proration law patterned after the Oklahoma statute.

Sharply conflicting views were voiced at a hearing conducted last night by the senate oil and gas committee on the Geddes oil proration bill. Members of the house oil and gas committee, which has favorably reported the companion Carpenter bill, joined in the hearing.

Pat Malloy, special counsel for the Sinclair Oil & Gas Co., opposed the bill, as did also Robert Hasty, attorney for the Derby Oil & Refining Co. C. C. Herndon, vice president of the Skelly Oil Co., favored the passage of the bill, and A. M. Landon, producer, of Independence, Kans., came out in a prepared statement favoring compulsory co-operation between companies and individuals and between states as the only means of stabilizing the industry. Governor Woodring was reported as favoring proration measures. Other witnesses were to be heard.

EMBARGO FIGHT LOST IN EXPIRING CONGRESS

By Charles E. Kern

Washington Bureau, The Oil and Gas Journal

WASHINGTON, D. C., Mar. 2.—The struggle for an embargo on the importation of oil from foreign countries has come to an end for this session of Congress. Representatives of the Governors' Oil Conference kept up their fight long after it appeared to many observers that it was impossible to get any action in this Congress.

The Senate Monday night refused to take up the Capper bill. This killed any chance of enactment of the measure at this session.

The bill was tabled on motion of Senator LaFollette, republican of Wisconsin, who termed the proposal of Senator Capper, republican, Kansas, for immediate consideration a "gesture" of the worst kind. He maintained the bill had no chance of passage before adjournment.

Russell B. Brown, secretary of the executive committee of the governors' conference, gave out the following statement:

"Three men, a subcommittee of the ways and means committee, have decided that oil relief legislation shall not even be considered at the present session of Congress."

Mr. Brown's statement followed a multitude of rumors passed about in the capitol respecting a last-hour drive that it was said might put over the embargo legislation, chief among which were statements that the house committee on rules headed by Speaker Longworth would force legislation. There were numerous conferences looking to this end but nothing came of them.

Compromise bills were proposed and the period of the embargo was reduced to two years as a further inducement to the opponents of legislation. There were rumors that Chairman Hawley had called another meeting of the ways and means committee to reconsider its action in declining to act on the measure, and members of the committee reported to attend the meeting only to learn that its calling was a fiction.

Speaker Longworth was freely quoted as favorable to legislation so worded as to conform to treaty conditions.

While efforts were going on in the House of Representatives, Senator Capper continued to work for consideration of his bill in the Senate, visiting the President to gain support for an embargo but even if it had been possible to push legislation through the House under a cloture rule unlimited debate in the Senate would have allowed a small group or even a single senator to defeat any action, had action been possible.

Russell Brown expressed gratification over legislation being enacted by the Senate which restored to the Navy appropriation bill and to the Shipping Board bill the clauses providing that none of the funds shall be used to purchase oil produced outside of the United States.

Orville Bullington, chairman of the executive committee of the Oil Conference, declared that the fight of the Independent Petroleum Association for legislation will be continued during this session and in the next Congress. He has called on President Hoover together with T. F. Hunter of Wichita Falls, Tex.

PRINCE VISITS PERU FIELD

NEW YORK, Mar. 2.—Peruvian executives of International Petroleum Co. and Lobitos Oilfields, Ltd., were hosts early this month to the Prince of Wales and his party. The British royal party landed at the Lobitos Oilfields port at Cabo Blanco and visited the production fields and the International Petroleum Co. refinery at Talara.

Fred Milne of Lobitos Oilfields, Ltd., and Mr. Leuseur of International Petroleum conducted the visiting party on its trip.

GEOLOGISTS' PROGRAM

DALLAS, Tex., Mar. 2.—Dallas petroleum geologists are planning on holding a meeting early in March, giving a three-part program which will include a discussion of the source of the Woodbine and Tokio sands; age of sands below the Brownstown, and paleontology of the Tokio. Brief papers will be given on each subject by geologists from Louisiana and East Texas with W. D. Spooner leading the discussion on the first subject and Dr. F. H. Lahee on the latter.

NATIONAL OIL SCOUTS

The executive committee of the National Oil Scouts Association will meet in Dallas, Tex., on March 14 to discuss plans for the 1931 convention which will no doubt be held in Dallas some time in May. Earl Whitcomb of the California Co., Midland, Tex., is chairman of this committee. The association has a paid-up membership of 566 members. March 7 the West Texas members of the association will give a dinner dance at the Hilton Hotel, San Angelo.

SPEEDS ARE SYNCHRONIZED

Exact agreement of operating speeds of two or more nonsynchronous electric motors can now be maintained by means of a new control system announced by the General Electric Co. This system, in which "selsyns" (small self-synchronizing motors) play a fundamental part, is expected to be of great advantage in industrial applications where synchronous operation of different machines or devices is essential.

PETROL GETS LARGE CONTRACT

Contract for approximately 4,000,000 gallons of road oil has been awarded to Petrol Corp. of Los Angeles, Calif., by the State of New Mexico. Petrol is adding more than 357,000 bbls. to the storage capacity at the refinery.

LINCOLN OIL PLANS BEACON

The Lincoln Oil Refining Co. is building the largest neon aviation beacon in the United States on the roof of the Merchants Bank Building in Indianapolis, Ind. This will be a 2,000,000 candle power guide to airmen, rising 122 feet above the building top and 375 feet above the street level. It will be visible for a distance of 75 miles. The torch itself will be 15 feet high neon tubing. The trademark, "Linco," will be displayed on the four sides in 10-foot letters.

The beacon is to be in operation by March 1, and is to operate from dusk to dawn, flashing 60 per cent of the time in accordance with the government's approved code.

CALIFORNIA OIL FIELD OPERATIONS FOR JANUARY, 1931

According to figures collected by the American Petroleum Institute, Pacific Coast office, the total production of crude oil in California for January amounted to 16,485,738 bbls., an average of 531,798 bbls. per day. This is a decrease of 41,967 bbls. per day under December production.

Total stocks of crude and all products in Pacific Coast territory decreased during the month 998,829 bbls. The total stocks at end of the month were 180,034,312 bbls.

Thirty-nine wells were completed during the month with an initial daily production of 39,346 bbls., compared with 65 wells and 34,690 bbls. in December.

Beginning with January, 1931, the California oil fields will be arranged alphabetically in three groups: Group No. 1 includes the San Joaquin Valley fields, Group No. 2 includes those west of the Coast Range and north of the Los Angeles Basin, and Group No. 3 includes the fields in the Los Angeles Basin.

PRODUCTION

(Figures of production and stocks are in barrels of 42 gallons)

	Bbls.	Daily average		
Group No. 1—	per month	Jan., 1931	Dec., 1930	Jan., 1930
Coalinga	275,559	8,889	8,998	9,224
Elk Hills	459,038	14,808	16,400	16,765
Fruitvale	64,203	2,071	2,421	3,142
Kern River	335,500	10,823	11,748	20,278
Kettleman Hills	691,096	22,293	22,966	12,995
Lost Hills-Belridge	200,535	6,469	6,501	5,007
McKittrick	114,890	3,706	3,619	4,773
Midway-Sunset	1,650,788	53,251	55,842	72,798
Mount Poso	235,603	7,600	8,528	12,569
Round Mountain	10,178	328	178	2,813
Wheeler Ridge	17,240	556	612	617
Group No. 2—				
Capitan	31,486	1,016	494	.....
Elwood	1,022,024	32,969	34,621	29,536
Rincon	72,908	2,352	2,544	3,478
Santa Barbara	7,161	231	158	98
Santa Maria	77,762	2,508	2,653	3,593
Summerland	8,188	264	275	436
Ventura Avenue	1,347,525	43,469	45,787	51,804
Ventura-Newhall	128,724	4,152	4,480	5,129
Watsonville	1,937	62	62	64
Group No. 3—				
Coyote	305,318	9,849	10,585	11,446
Domingues	306,686	9,893	9,851	10,729
Fullerton (Brea Olinda)	329,648	10,634	10,640	13,209
Huntington Beach	706,862	22,802	25,749	41,046
Inglewood	478,377	15,448	15,649	21,971
Lawndale	10,009	323	326	714
Long Beach	2,877,291	92,816	93,995	106,380
Los Angeles-Salt Lake	43,821	1,414	1,335	1,602
Montebello	216,612	6,955	7,311	8,597
Newport	1,235	40	40	40
Playa Del Rey	1,102,265	35,589	40,291	1,325
Potrero	33,678	1,086	1,540	768
Richfield	211,410	6,820	7,768	14,105
Rosecrans	140,523	4,533	6,447	6,943
Santa Fe Springs	2,222,519	71,694	85,918	171,042
Seal Beach	521,660	16,828	17,007	30,016
Torrance	181,945	5,869	9,022	12,623
Whittier	43,034	1,388	1,404	1,476
Total	16,485,738	531,798	573,765	709,137
December	17,786,728	573,765		
Decrease	1,300,990	41,967		

STOCKS

	Jan. 31, 1931	Dec. 31, 1930	January stock decreases	Jan. 31, 1930
Heavy crude, heavier than 20° A.P.I., including all grades fuel	107,742,194	109,419,521	1,677,327	113,073,237
Refinable crude, 20° A.P.I. and lighter	42,468,218	42,744,491	276,273	42,068,114
Gasoline	17,692,377	17,241,334	*451,043	17,825,998
Naphtha distillates	3,314,982	2,937,081	*377,901	2,566,998
All other stocks	8,816,541	8,690,714	*125,827	10,812,196
Total all stocks	180,034,312	181,033,141	998,829	186,346,543

*Increase.

DEVELOPMENT

	New rigs up	Active drilling	Completed	Daily initial output	Active producing	Abnd. wells Drillers	Abnd. wells Producers
Group No. 1—							
Buttonwillow gas field	..	1	..	.....	.....	1	..
Coalinga	..	..	..	.....	730	..	..
Elk Hills	..	..	..	.....	209	..	..
Fruitvale	..	..	..	.....	17	1	..
Kern River	..	1	2	255	891	..	..
Kettleman Hills	..	15	1	5,353	9	..	..
Lost Hills-Belridge	2	15	..	.....	163	..	1
McKittrick	..	..	..	.....	237	..	..
Midway-Sunset	1	4	..	.....	1,790	1	3
Mount Poso	..	..	..	.....	66	..	..
Round Mountain	..	..	..	.....	3	..	..
Wheeler Ridge	..	..	..	.....	34	..	..
Group No. 2—							
Capitan	..	1	1	215	5	..	..
Elwood	..	1	2	11,190	54	..	..
Rincon	..	2	..	.....	38	..	..
Santa Barbara	1	1	1	265	3	..	..
Santa Maria	..	1	..	.....	184	..	..
Summerland	..	..	..	.....	97	1	..
Ventura Avenue	1	20	2	3,375	147	..	..
Ventura-Newhall	..	9	..	.....	414	..	..
Watsonville	..	..	..	.....	6	..	..
Group No. 3—							
Coyote	1	1	..	.....	182	..	..
Domingues	..	2	..	.....	62	..	..
Fullerton	..	1	1	50	368	..	..
Huntington Beach	1	4	..	.....	403	..	..
Inglewood	..	2	..	.....	211	..	..
Lawndale	..	..	..	.....	8	..	..
Long Beach	2	49	6	4,148	907	1	3
Los Angeles-Salt Lake	..	..	..	.....	259	..	..
Montebello	..	..	..	.....	164	..	..
Newport	..	1	..	.....	4	..	..
Playa Del Rey	4	34	21	14,445	160	1	..
Potrero	..	2	2	150	19	..	..
Richfield	..	..	..	.....	175	..	..
Rosecrans	..	1	..	.....	100	1	..
Santa Fe Springs	..	..	..	.....	464	1	2
Seal Beach	..	2	..	.....	125	..	2
Torrance	..	..	..	.....	525	..	..
Whittier	..	..	..	.....	159	..	..
Miscellaneous drilling	15	154	..	.....	.....	6	..
January	28	325	39	39,346	9,387	13	11
December	43	370	65	34,690	9,454	30	22
Decrease	15	45	26	*4,656	67	17	11
Average for year 1930	30	434	63	48,710	9,623	21	27
Average for year 1929	109	610	76	100,625	10,550	26	18
Average for year 1928	107	520	69	56,802	10,823	15	25
Average for year 1927	97	404	75	39,992	11,376	33	31
Average for year 1926	96	422	76	32,635	11,388	34	17

*Increase.

REFINERY AND CRUDE PRICES

Quotations on refined products are for interstate or export movement unless otherwise noted.

GASOLINE AND NAPHTHA

	Mar. 3		Feb. 24		Feb. 17	
OKLAHOMA (Group 3)—						
50-52 450 endpoint	.03¾	.04⅛	.04	.04¼	.04	.04¼
56-58 450 endpoint	.03¾	.04	.03⅞	.04	.04	.04¼
58-60 437 endpoint (U. S. Motor)	.03¾	.04⅜	.04	.04⅜	.04	.04⅜
60-62 437 endpoint	.04	.04⅜	.04⅛	.04⅜	.04¼	.04⅜
60-62 400 endpoint	.04	.04⅜	.04¼	.05	.04⅜	.05
64-66 375 endpoint	.04⅜	.05	.04½	.05¼	.04⅝	.05½
68-70 360 endpoint	.05	.05¼	.05	.05½	.05	.05½
64-66 437 endpoint (blend)	.03⅞	.04	.03¾	.04¼	.03⅞	.04¼
NORTH TEXAS—						
50-52 450 endpoint	.03¾	.04	.03⅞	.04	.03⅞	.04
58-60 450 endpoint	.03⅝	.03¾	.03¾	.04	.03⅞	.04
58-60 437 endpoint (U. S. Motor)	.03¾	.04¼	.03⅞	.04¼	.04	.04¼
60-62 400 endpoint	.04	.04¼	.04⅛	.04¼	.04⅛	.04⅜
64-66 390 endpoint	.04	.04⅜	.04¼	.04½	.04¼	.04½
64-66 375 endpoint	.04¼	.04½	.04½	.04⅝	.04⅛	.04⅝
68-70 360 endpoint	.04⅝	.05	.04⅞	.05¼	.04⅞	.05¼
64-66 437 endpoint (blend)	.03⅝	.03¾	.03¾	.04¼	.03⅞	.04¼
***NORTH LOUISIANA—**						
58-60 437 endpoint (U. S. Motor)	.04¼	.04⅜	.04⅜	.04⅜	.04⅜	.04⅜
***ARKANSAS—**						
58-60 437 endpoint (U. S. Motor)	.04¼	.04⅝	.04¼	.04⅜	.04⅝	.04⅜
PENNSYLVANIA—						
52-54 Naphtha	.05⅜		.06		.06	
54-56 Naphtha	.05⅝		.06		.06	
58-60 Gasoline	.05⅝		.06		.06	
60 Gasoline	.05⅝		.06	.06¼	.06	.06¼
62 Gasoline	.06		.06¼		.06¼	.06½
64 Gasoline	.06¼	.06½	.06¼	.06⅝	.06¼	.06⅝
68-70 350 endpoint gasoline	.07¼		.07¼		.07½	
CALIFORNIA—						
†54-58 437 endpoint (U. S. Motor) domestic	.05½	.06½	.08½	.10¼	.08	.10
†58-62 400 endpoint domestic gasoline	.08	.09½	.09	.10½	.09	.10½
CHICAGO DISTRICT (Based on Group 3)—						
50-52 450 endpoint (Naphtha)	.03¾	.04	.03⅞	.04	.03⅞	.04
56-58 450 endpoint	.03⅝	.03⅞	.03⅞	.04	.03⅝	
58-60 437 endpoint (U. S. Motor)	.03¾	.04⅛	.03⅞	.04¼	.04	.04¼
60-62 400 endpoint	.04	.04¼	.04¼	.04⅜	.04¼	.04⅜
64-66 375 endpoint	.04¼	.04½	.04½	.04⅝	.04½	
64-66 437 endpoint (blend)	.03¾		.03¾	.04	.03⅞	.04¼
68-70 360 endpoint	.04¾	.05	.04⅞	.05¼	.04⅞	.05¼
GULF COAST (Export)—						
58-60 U. S. Motor	.04½	.05	.05¼		.05¼	
60-62 400 endpoint	.04¾	.05¼	.05½		.05½	
61-63 390 endpoint	.05⅝		.05⅞		.05⅞	
64-66 375 endpoint	.05⅞	.06	.06⅛	.06¼	.06⅛	.06¼

*Louisiana, Arkansas, Mississippi and East Texas delivery. †For local consumption.

NATURAL GASOLINE

	Mar. 3		Feb. 24		Feb. 17	
OKLAHOMA (Group 3)—						
Grade A, 72-79.9, 375 e.p., rec. 90%	.03¼	.03½	.03½		.03¾	
Grade AA, 80-87.9, 375 e.p., rec. 90%	.03		.03¼		.03½	
Grade B, 76-83.9, 375 e.p., rec. 85%	.02⅝	.02¾	.02¾		.03	
Grade BB, 84-92, 375 e.p., rec. 85%	.02½		.02⅝		.03	
Grade C, 80-92, 375 e.p., rec. 78%	.02½		.02¾		.03	
NORTH TEXAS—						
Grade A, 72-79.9, 375 e.p., rec. 90%	.03¼	.03½	.03½		.03¾	
Grade AA, 80-87.9, 375 e.p., rec. 90%	.03		.03¼		.03½	
Grade B, 76-83.9, 375 e.p., rec. 85%	.02½		.02¾		.03	
Grade BB, 84-92, 375 e.p., rec. 85%	.02½		.02¾		.03	
Grade C, 80-92, 375 e.p., rec. 78%	.02½		.02¾		.03	
NORTH LOUISIANA—						
Grade AA, 80-87, 375 e.p., rec. 90%	.03¼	.03½	.03½		.03¾	
Grade BB, 84-92, 375 e.p., rec. 85%	.02⅝		.03		.03½	.03¼
Grade C, 80-92, 375 e.p., rec. 78%	.02½		.03		.03⅛	.03¼
CALIFORNIA—						
75-78 375-390 endpoint	.05	.06	.05	.06	.05	.06
CHICAGO DISTRICT (Based on Group 3)—						
Grade A ,72-79.9, 375 e.p., rec. 90%	.03¼		.03½		.03¾	
Grade AA, 80-87.9, 375 e.p., rec. 90%	.03		.03¼		.03½	
Grade BB, 84-92, 375 e.p., rec. 85%	.02½		.02¾		.03	

BURNING OIL

	Mar. 3		Feb. 24		Feb. 17	
OKLAHOMA (Group 3)—						
41-43 water white kerosene	.02⅞	.03	.03	.03¼	.03	.03¼
42-44 water white kerosene	.03¼		.03¼	.03½	.03¼	.03¾
NORTH TEXAS—						
41-43 water white kerosene	.02¾	.03	.02⅞	.03	.03	.03⅛
40-41 water white kerosene	.02⅝	.02¾	.02¾	.03	.02⅞	.03
***NORTH LOUISIAN..—**						
41-43 water white kerosene	.03¼	.03¾	.03½	.04	.03½	.04
***ARKANSAS—**						
41-43 water white kerosene	.03¼	.03¾	.03½	.04	.03½	.04
PENNSYLVANIA—						
43 Kerosene prime white	.04⅝		.04⅞		.04⅞	
45 Kerosene water white	.04¾	.04⅞	.04⅞	.05	.04⅞	.05
46 Kerosene water white	.05	.05¼	.05	.05¼	.05	.05¼
CALIFORNIA—						
38-40 water white Kero. (high burning test)	.04¾	.06	.04¾	.06	.04¾	.06
CHICAGO DISTRICT (Based on Group 3)—						
41-43 water white kerosene	.02⅞	.03	.02⅞	.03	.02⅞	.03¼
42-44 water white kerosene	.03¼		.03¼	.03½	.03¼	.03½
GULF COAST (Export)—						
41-43 prime white	.04¼		.04¼		.04½	
44 water white	.05¼		.05¼		.05¼	

*Louisiana, Arkansas, Mississippi and East Texas delivery.

FUEL OIL

	Mar. 3		Feb. 24		Feb. 27	
***OKLAHOMA (Group 3)—**						
Below 18 gravity Fuel Oil, per bbl.	.40	.45	.40	.45	.40	.45
18-22 Fuel Oil, per bbl.	.42½	.50	.42½	.50	.42½	.50
20-22 Fuel Oil, per bbl.	.45	.55	.45	.55	.47½	.55
22-26 Fuel Oil, per bbl.	.50	.60	.50	.60	.55	.60
24-26 Fuel Oil, per bbl.	.57½	.65	.57½	.65	.60	.65
26-30 Fuel Oil, per bbl.	.65	.70	.65	.70	.65	.75
28-30 Fuel Oil, per bbl.	.75	.85	.75	.85	.80	.90
32-36 Gas Oil (industrial)	.01¾	.02	.02	.02½	.02	.02½
32-36 Gas Oil (straw color, high cold test)	.01⅞	.02	.02	.02½	.02½	.02¾
32-36 Gas Oil (straw color, low cold test)	.02⅝	.02½	.02⅝	.02½	.02⅝	.02½
36-38 Distillate	.02½	.02½	.02½	.02⅝	.02½	.02¾
38-40 Straw Distillate	.02½	.02⅞	.02⅝	.03	.02¾	.03

*Prices on fuel oil above 40 cold test usually from 5 to 10 cents under general quotations.

NORTH TEXAS—						
Below 20 gravity Fuel Oil, per bbl.	.30	.35	.30	.35	.30	.35
24-26 Fuel Oil, per bbl.	.45	.50	.45	.50	.45	.55
32-36 Gas Oil (industrial)	.01¾	.02	.01⅞	.02	.01⅞	.02½
38-40 Straw Distillate	.02⅝	.02¾	.02½	.02¾	.02½	.02¾
***NORTH LOUISIANA—**						
18-20 Fuel Oil, per bbl.	.70	.75	.70	.75	.70	.75
30-32 Gas Oil (low cold test)	.02⅝	.02¾	.02⅞	.03	.02⅞	.03
***ARKANSAS—**						
33-36 Distillate	.02¾	.03	.02¾	.03	.02¾	.03
30-32 Gas Oil	.02¼	.02⅝	.02½	.02¾	.02⅝	.02¾
16-22 Refinery Fuel Oil, per bbl.	.60	.65	.60	.65	.60	.65
GULF COAST (South Texas)—						
Gas Oil	.03⅛	.03¼	.03⅛	.03¼	.03⅛	.03¼
Bunker C Fuel (cargo lots), per bbl.	.65	.70	.65	.70	.65	.70
Bunker C Fuel (small lots)	.90		.90		.90	
PENNSYLVANIA—						
30-34 Fuel Oil	.03½		.03⅝		.03⅝	
36-40 Fuel Oil	.03¼		.03¼		.03½	
CALIFORNIA—						
33-36 Distillate	.02	.02½	.02	.02½	.02	.02½
26-32 Distillate	.01¾	.02	.01¾	.02	.01¾	.02
15-19 Fuel Oil, Bunker (at tidewater), bbl.	.60	.90	.55	.90	.55	.90
15-19 Fuel Oil (cargo lots, at tidewater), bbl.	.55	.80	.50	.80	.50	.80
†15-19 Fuel Oil, f.o.b. tank cars	.35	.75	.25	.70	.25	.70
27 plus Diesel, per bbl.	.80	1.05	.80	1.05	.80	1.05
30-34 Gas Oil	.85	1.15	.85	1.05	.85	1.05
CHICAGO DISTRICT (Based on Group 3)—						
18-22 Fuel Oil, per bbl.	.45	.55	.45	.55	.50	.55
22-26 Fuel Oil, per bbl.	.55	.60	.55	.60	.55	.60
28-30 Fuel Oil, per bbl. (zero)	.80	.85	.80	.85	.85	.90
32-36 Gas Oil (industrial)	.01¾	.02	.01⅞	.02	.01⅞	.02½
32-36 Gas Oil (zero)	.02⅜	.02½	.02⅜	.02½	.02½	.02⅞
38-40 Straw Distillate	.02⅞		.02¾	.03	.02¾	.03

*Louisiana, Arkansas, Mississippi and East Texas delivery. †Lowest priced fuel oil has high sulphur content.

LUBRICATING OIL AND WAX

	Mar. 3		Feb. 24		Feb. 17	
OKLAHOMA (Group 3)—						
100 vis., 2 color, 20-25 cold test	.05	.05½	.05	.05½	.05	.05½
100 vis., 3 color, 20-25 cold test	.04¾	.05	.04¾	.05	.04¾	.05
150 vis., 3 color, 20-25 cold test	.07		.07		.07	
150 vis., 4 color, 20-25 cold test	.06½		.06½		.06½	
180 vis., 3 color, 23-28 cold test	.08½		.08½		.08½	
180 vis., 4 color, 23-28 cold test	.08		.08		.08	
180 vis., 5 color, 23-28 cold test	.07¼	.07½	.07¼	.07½	.07¼	.07½
200 vis., 3 color, 23-28 cold test	.09¾	.10	.09¾	.10	.09¾	.10
200 vis., 4 color, 23-28 cold test	.09½		.09½		.09½	
200 vis., 5 color, 23-28 cold test	.09		.09		.09	
240 vis., 3 color, 25-30 cold test	.13¼	.13½	.13¼	.13½	.13¼	.13½
240 vis., 4 color, 25-30 cold test	.12½	.12⅞	.12½	.12⅞	.12½	.12⅞
240 vis., 5 color, 25-30 cold test	.11½	.11⅞	.11½	.11⅞	.11½	.11⅞
280 vis., 3 color, 25-30 cold test	.15⅛		.15⅛		.15⅛	
280 vis., 4 color, 25-30 cold test	.14⅛		.14⅛		.14⅛	
280 vis., 5 color, 25-30 cold test	.13⅛		.13⅛		.13⅛	
Cylinder Stocks:						
600, steam refined, light green	.06	.07	.06	.07	.07	.08
600, steam refined, dark green	.04½	.05½	.04½	.05½	.04½	.05½
190-200 vis., D color, Bright Stocks	.25		.25		.25	
150-160 vis., D color, Bright Stocks 0-10 c.t.	.18	.19	.18	.19	.19	.20
150-160 vis., D color, Bright Stocks 10-25 c.t.	.17	.18	.17	.18	.18	.19
150-160 vis., D color, Bright Stocks 25-40 c.t.	.16½	.17½	.16½	.17½	.17½	.18½
150-160 vis., E color, Bright Stocks	.17	.18	.17	.18	.17	.18
Waxes:						
124-126 White Crude Scale Wax	.02	.02½	.02	.02⅛	.02	.02⅛

All bright stock prices are for domestic movement.

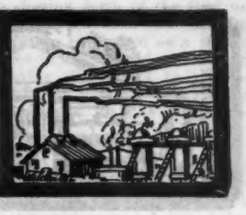
PENNSYLVANIA—						
34 Neutral	.05½	.06	.05½	.06	.05½	.06
34 Sundebloom	.05½		.05½		.05½	
36 Miners' Neutral	.05	.05½	.05	.05½	.05	.05½
150, 3 color	.14	.16	.14	.16	.12	.12½
180, 3 color	.16	.17	.16	.17	.16	.16½
200, 3 color	.18½	.19	.18½	.19	.17	.18½
220, 3 color	.23	.24	.23	.24	.21	.22
600, steam refined	.08½	.09	.08½	.09	.08½	.09
650, steam refined	.12	.13	.12	.13	.12	.13
600, Pennsylvania Flash	.13	.14	.13	.14	.13	.14
630, Pennsylvania Flash	.18½	.19½	.19	.20	.19	.20
600, E filtered	.12		.12		.12	
600, D filtered, Oil City	.17	.18	.17	.18	.17	.18
Pennsylvania Bright Stocks below 35 C.T.	.18	.19	.18	.19	.18	.19
Pennsylvania Bright Stocks above 35 C.T.	.17		.17		.17	
*122-124 White Crude Scale Wax	.02⅛		.02⅜		.02⅜	
124-126 White Crude Scale Wax	.02⅛		.02⅜		.02½	

*At New York.

GULF COAST (South Texas)—						
100 vis., 2-2½ color, pale oil	.06	.06¼	.06	.06¼	.06	.06½
200 vis., 3 color, pale oil	.08¼	.08½	.08¼	.08½	.08¼	.08½
300 vis., 3 color, pale oil	.09½	.09¾	.09½	.09¾	.09½	.09¾
500 vis., 3½ color, pale oil	.10¾	.11	.10¾	.11	.10¾	.11
750 vis., 3½ color, pale oil	.12¼	.12½	.12¼	.12½	.12¼	.12½
1,200 vis., 3½ color, pale oil	.14¾	.15	.14¾	.15	.14¾	.15
2,000 vis., 4 color, pale oil	.15¾	.16	.15¾	.16	.15¾	.16
200 vis., 5-6 color, red oil	.07½	.07¾	.07½	.07¾	.07½	.07¾
300 vis., 5-6 color, red oil	.08¾	.09	.08¾	.09	.08¾	.09
500 vis., 5-6 color, red oil	.10	.10¼	.10	.10¼	.10	.10¼

REFINERY AND CRUDE PRICES

Quotations on refined products are for interstate or export movement unless otherwise noted.



750 vis., 5-6 color, red oil	.11	.11¾	.11½	.11¾	.11½	.11¾
1,200 vis., 5-6 color, red oil	.13¾	.14	.13¾	.14	.13¾	.14
2,000 vis., 6 plus color	.15¾	.16	.15¾	.16	.15¾	.16
CALIFORNIA—						
130 vis., 2½-3 color	.09	.09½	.09	.09½	.09	.09½
200 vis., 2½-3 color	.10	.10¾	.10	.10¾	.10	.10¾
300 vis., 3-3½ color	.10¾	.11½	.10¾	.11½	.10¾	.11½
350 vis., 3½-4 color	.11½	.11¾	.11½	.11¾	.11½	.11¾
400 vis., 3½-4 color	.12¼	.12¾	.12¼	.12¾	.12¼	.12¾
Red Neutral:						
200 vis., 4½-5 color	.09½	.10	.09½	.10	.09½	.10
300 vis., 5-6 color	.10¼	.10¾	.10¼	.10¾	.10¼	.10¾
400 vis., 5-6 color	.11	.12	.11	.12	.11	.12
500 vis., 4½-5 color	.12¼	.13	.12¼	.13	.12¼	.13
500 vis., 5-6½ color	.12	.12¾	.12	.12¾	.12	.12¾
600 vis., 6½ plus color	.13	.14	.13	.14	.13	.14

Note—Bright stocks are not manufactured commercially on the Pacific Coast.

NEW YORK (BAYONNE) REFINERY PRICES

	Mar. 3		Feb. 24		Feb. 17	
Gasoline, U. S. Motor, 58-60, 437 e.p.	.07½	.08	.07½	.08	.07	.08
Kerosene, water white, 41-43	.06¼	.06½	.06¼	.06½	.06¼	.06½
*Fuel Oil, Bunker "C," 41-43	1.05		1.05		1.05	
†Fuel Oil, Diesel, 28-30, per bbl.	1.85		1.85		1.85	
Gas Oil, 28 gravity plus	.04½	.05¼	.04¼	.05¼	.04¼	.05¼
25 pale Paraffin Oil, tank car	.10½		.10¼		.10¼	
28 pale Paraffin Oil, tank car	.07½		.07¼		.07¼	
280 red Paraffin Oil, tank car	.12½		.12½		.12½	
250 red Paraffin Oil, tank car	.11½		.11½		.11½	
225 red Paraffin Oil, tank car	.10		.10		.10	
200 red Paraffin Oil, tank car	.09¼		.09¼		.09¼	
Domestic heating oil, min. 32 grav., tank car	.04½		.04½		.04½	
Refined Wax:						
120-122 a.m.p., per lb.	.03		.03½		.03½	
125-127 a.m.p., per lb.	.03⅝		.03½		.03½	
130-132 a.m.p., per lb.	.03⅝		.03¾		.03¾	
133-135 a.m.p., per lb.	.04⅛		.04⅛		.04⅛	
135-137 a.m.p., per lb.	.04⅛		.04¾		.04¾	
Petrolatum in barrels in carload lots, per pound:						
Dark Green	.01¾		.01¾		.01¾	
Amber	.03		.03½		.03½	
Extra Amber	.03¼		.03⅜		.03⅜	
Cream	.06		.06		.06	
Lily White	.06¾		.06¾		.06¾	
Snow White	.08		.08		.08	

*Lighterage 5 cents a barrel extra. †Lighterage 6.5 cents a barrel.

NEW YORK (BAYONNE) EXPORT PRICES

	Mar. 3	Feb. 24	Feb. 17
600, steam refined cylinder stocks, in bbls.	.16¾	.16¾	.16½
635, steam refined	.17½	.17½	.17½
650, steam refined	.20½	.20½	.21
600, Pennsylvania Flash	.21	.21	.21½
630, Pennsylvania Flash	.28	.28	.28½
600, Warren E	.22	.22	.23
600, Oil City E	.21	.21	.22
Light 140-150 Bright Stocks	.25½ .26	.25½ .26	.25 .26
Dark 140-150 Bright Stocks	.23½ .24	.23½ .24	.23 .24

LOS ANGELES EXPORT PRICES

	Mar. 3		Feb. 24		Feb. 17	
Kerosene, water white	.04¾	.06	.04¾	.06	.04¾	.06
*U. S. Motor Gasoline, 53-55, 437 e.p.	.04¾	.06¾	.04¾	.07	.04¾	.07
*60-62, 400 endpoint gasoline	.05¾	.07½	.06	.08	.06	.08

*For coastwise shipment.

CRUDE OIL PRICES

OKLAHOMA, KANSAS, NORTH AND EAST CENTRAL TEXAS

Rusk County, Tex.* (Feb. 10, 1931) ...$ .40
Corsicana heavy (Oct. 28) ..... .75
Other fields .....See gravity table

*Posted by Panola Pipe Line Co.

TEXAS PANHANDLE

Gray County, Wheeler County and Carson-Hutchinson Counties ....See gravity table

WEST TEXAS

Iatan* .....Same as North Texas
Crane-Upton-Crockett, Howard and Glasscock, Mitchell and Ector .....
.....See gravity table, Column 2
Chalk† (April 10, 1930) $0.75

*Includes Westbrook Field. †Posted by Humble Oil & Refining Co.

ARKANSAS-NORTH LOUISIANA

Smackover (all grades) (Oct. 30, 1930).$0.70
Carterville, Sarepta and Cotton Valley, below 36 gravity .....See gravity table
Bellevue (Oct. 30, 1930) 1.00
Urania (Oct. 30, 1930) ..... .75
Calion, heavy (Oct. 30, 1930) ..... .70
East El Dorado (Oct. 30, 1930) ..... .70
Other fields .....See gravity table

Note—Smackover and Bellevue posted by Standard Oil Co. of Louisiana and Magnolia Petroleum Co.; Urania posted by Louisiana Oil Refining Corp.; East El Dorado posted by Gulf Refining Co. and Magnolia Petroleum Co.; Calion posted by Gulf Refining Co.

GULF COAST

Grade A (Jan. 14)* $0.30
Grade B, 25° and upward...See gravity table
Jennings, La. (Oct. 30, 1930)† ..... .30
Refugio (light) .....Same as Grade B
Refugio (heavy) (Jan. 14)* ..... .50
Markham (Jan. 15, 1931)‡ ..... .60
High Island (Oct. 30, 1930)† ..... .75

*Humble Oil & Refining Co. †Gulf Refining Co. of Louisiana. ‡Texas Pipe Line Co.

ROCKY MOUNTAIN STATES

Ohio Oil Co.-Midwest Refining Co.

Ilse (Feb. 15, 1930) $0.87
33 gravity and above ..... .87
Under 33 gravity ..... .65
Dutton Creek (Oct. 28, 1930) 1.01
Rock Creek, Wyo. (Oct. 28, 1930) 1.01
Salt Creek .....See gravity table
Big Muddy (Oct. 28, 1930) 1.00
Grass Creek, heavy (July 27, 1928) .... .90
Grass Creek, light (Oct. 28, 1930) 1.35
Mule Creek (May 21, 1929) 1.30
Elk Basin (Oct. 28, 1930) 1.35
Lance Creek (Oct. 28, 1930) 1.33
Poison Spider (Mar. 14, 1927) 1.00
Notches (Mar. 14, 1927) ..... .65
Dallas-Derby (Jan. 1, 1931) ..... .70
Hudson (Jan. 1, 1931) ..... .75
Rex Lake (Feb. 22, 1930) 1.10
Osage (Nov. 1, 1930) ..... .85
Lost Soldier (Oct. 28, 1930) ..... .80
Hamilton Dome (Mar. 14, 1927) ..... .85
Greybull (Oct. 28, 1930) 1.35
Torchlight (Oct. 28, 1930) 1.35
Cat Creek (Oct. 28, 1930) 1.35
Pondera (Montana) (Oct. 28, 1930) 1.45
Sunburst (Montana) (Oct. 28, 1930) 1.55
Hogback (Feb. 15, 1930) 1.40
Artesia (New Mexico) (Oct. 28, 1930).. .75
Lea County .....See gravity table
Border, Mont. 1.55
Red Coulee, Alberta 1.55

Note—Salt Creek, Osage, Cat Creek, Dallas-Derby, Hudson, Greybull and Hogback posted by Midwest Refining Co. and the remainder by the Ohio Oil Co. Both com-

(Continued on Page 190)

CRUDE OIL GRAVITY TABLE

Gravity—	Oklahoma-Kansas, Central and East Central Texas, North La.-Ark. 1	North Texas (Wichita Falls district) 2	Crane, Upton, Ector, Crockett, Howard, Glasscock, Mitchell (West Texas), Lea, N. Mex. 3	Wheeler County (Texas Panhandle) 4	Gray County (Texas Panhandle) 5	Carson and Hutchinson (Texas Panhandle) 6	Salt Creek, Wyo. 7	Stephens, Ark. 8	Winkler-Pecos (West Texas) 9	Grade B Gulf Coast and Refugio, Texas 10
Below 25	....	....	.50	....	....	....	....	....	.55	.69
25 to 25.9	....	....	.52	....	....	....	....	....	.57	.71
26 to 26.9	....	....	.54	....	....	....	....	....	.59	.73
27 to 27.9	....	....	.56	....	....	....	....	....	.61	.75
28 to 28.9	....	....	.58	....	....	....	....	....	.63	.77
Below 29	.65	.55	....	....	.48	.43	....	.54	....	....
29 to 29.9	.69	.57	.60	....	.50	.45	.69	.58	.65	.79
30 to 30.9	.73	.59	.62	....	.52	.47	.73	.62	.67	.81
31 to 31.9	.77	.61	.64	....	.54	.49	.77	.66	.69	.83
32 to 32.9	.81	.63	.66	....	.56	.51	.81	.70	.71	.85
33 to 33.9	.85	.65	.68	....	.58	.53	.85	....	.73	.87
34 to 34.9	.89	.67	.70	....	.60	.55	.89	....	.75	.89
35 to 35.9	.92	.69	.72	....	.62	.57	.92	....	.77	.91
36 to 36.9	.95	.71	.74	....	.64	.59	.95	....	.79	.93
37 to 37.9	.98	.73	....	....	.66	.61	.98	....	....	.95
38 to 38.9	1.01	.75	....	....	.68	.63	....	....	....	.97
39 to 39.9	1.04	.77	....	....	.70	.65	....	....	....	.99
40 and above	1.07	.79	....	....	.72	.67	....	....	....	1.01

Column 1—Carter Oil Co. posted price schedule for Oklahoma and Kansas on October 28, 1930. Humble Oil & Refining Co. posted for North and Central Texas and East Central Texas on October 28 but made new price schedule on January 14, 1931, affecting North Texas or Wichita Falls district (see Column 2). All other companies adopted Column 1 schedule.

Column 2—Humble Oil & Refining Co. posted above prices on North Texas, Wichita, Wilbarger, Archer and North Young Counties, on January 14; The Texas Company on November 15; Stanolind Crude Oil Purchasing Co. on January 16; Gulf Refining Co. on January 14; H. F. Wilcox Oil & Gas Co. on January 14. Other companies applied the schedule to all North Texas counties in which they bought, including Clay, Montague and Foard.

Column 3—Posted by Humble Oil & Refining Co. on October 28.

Column 4—Companies quit posting April 10, but crude takes present Hutchinson-Carson prices.

Column 5—Humble Oil & Refining Co. posted above prices January 14, 1931; other purchasers adopted schedule.

Column 6—Humble Oil & Refining Co., January 14.

Column 7—Midwest Refining Co. on October 28. All crude over 37 degrees 98 cents.

Column 8—Louisiana Oil & Refining Co. and Atlantic Oil Producing Co., October 30.

Column 9—Humble Oil & Refining Co., October 28.

Column 10—Humble Oil & Refining Co. posted above prices on January 14, 1931, thus meeting the Gulf Pipe Line Co. and Gulf Refining Co. of Louisiana's price schedule posted on October 30, 1930.

CALIFORNIA CRUDE OIL PRICES

Standard Oil Co. (effective September 15, 1930), Union Oil Co. (effective September 15, 1930)

Gravity—	Long Beach, Seal Beach, Alamitos Hts., Huntington Beach, Inglewood, Torrance, Richfield, Olinda, Brea Canyon 1	Whittier, La Habra, Coyote Hills 2	Midway-Sunset, Elk Hills, Lost Hills, Belridge, Buena Vista Hills 3	Montebello 4	Santa Fe Springs 5	Santa Maria, Coalinga 6	Wheeler Ridge 7	Orcutt, Ventura, Rincon 8	Ventura Avenue 9	Elwood Terrace 10	Athens, Rosecrans, Dominguez 11
14 to 14.9	.70	.70	.55	.70	....	.55	.55	.55	.70	....	....
15 to 15.9	.70	.70	.55	.70	....	.55	.55	.55	.70	....	....
16 to 16.9	.70	.70	.55	.70	....	.55	.55	.55	.70	....	....
17 to 17.9	.70	.70	.55	.70	....	.55	.55	.55	.70	....	....
18 to 18.9	.76	.76	.62	.71	....	.62	.62	.65	.76	....	....
19 to 19.9	.82	.82	.70	.77	....	.70	.70	.70	.82	....	....
20 to 20.9	.88	.87	.78	.83	....	.78	.78	.78	.88	....	....
21 to 21.9	.94	.92	.86	.90	.92	.86	.86	.90	.91	....	....
22 to 22.9	1.00	.98	.94	.97	.95	.94	.94	.95	.94	....	....
23 to 23.9	1.07	1.04	1.02	1.05	1.01	1.02	1.02	1.02	1.00	....	....
24 to 24.9	1.12	1.08	1.06	1.08	1.05	1.04	1.04	1.08	1.05	....	1.13
25 to 25.9	1.17	1.12	1.10	1.11	1.09	1.06	1.06	1.11	1.10	....	1.17
26 to 26.9	1.22	1.16	1.14	1.15	1.13	1.08	1.08	1.15	1.15	....	1.22
27 to 27.9	1.26	1.21	1.18	1.19	1.18	1.11	1.10	....	1.19	....	1.27
28 to 28.9	1.30	1.25	1.23	1.23	1.23	1.15	....	....	1.23	....	1.32
29 to 29.9	1.34	1.29	1.29	1.26	1.28	1.19	....	....	1.27	....	1.37
30 to 30.9	1.38	1.33	1.35	1.29	1.33	1.23	....	....	1.31	....	1.42
31 to 31.9	1.43	....	1.40	....	1.38	1.27	....	....	1.35	....	1.47
32 to 32.9	1.48	....	1.47	....	1.43	1.31	....	....	1.41	....	1.52
33 to 33.9	....	....	1.53	....	1.48	1.35	....	....	1.47	....	1.57
34 to 34.9	....	....	1.59	....	1.53	1.39	....	....	1.53	1.52	1.62
35 to 35.9	....	....	1.65	....	1.58	1.43	....	....	1.59	1.59	1.66
36 to 36.9	....	....	....	....	1.63	....	....	....	....	1.65	1.72
37 to 37.9	....	....	....	....	1.68	....	....	....	....	1.53	1.78
38 to 38.9	....	....	....	....	1.73	....	....	....	....	1.60	1.84
39 to 39.9	....	....	....	....	1.78	....	....	....	....	1.66	1.90
40 to 40.9	....	....	....	....	....	....	....	....	....	1.72	1.96
41 to 41.9	....	....	....	....	....	....	....	....	....	1.78	2.02
42 to 42.9	....	....	....	....	....	....	....	....	....	1.84	2.08

Note—Standard Oil Co. of California, effective December 18, 1930, established the following posted prices for oil purchased in the Playa Del Rey Field: 20-20.9 degrees, 74 cents; 21-21.9 degrees, 77 cents; 22-22.9 degrees, 81 cents; 23-23.9 degrees, 84 cents; 24-24.9 degrees, 87 cents; 25 degrees and above, 90 cents. Union Oil Co. adopted same price schedule on December 18. On January 20 the Union Oil Co. announced a gathering charge of 5 cents per barrel for receiving and delivering the oil into its pipe line.

Kern River, Newhall-McKittrick, Mount Poso and Round Mountain, 11 to 13.9 gravity, 50 cents; 14 gravity and above, 55 cents, effective March 11. On March 11 the Union Oil Co. posted Midway-Sunset, Elk Hills, Buena Vista, Lost Hills and Coalinga crude as follows: 11 to 13.9 gravity at 50 cents. Fruitvale, posted by General Petroleum Co., 11-13.9, 50 cents; 14 gravity and above, 55 cents.

Column 1—Signal Hill, Seal Beach, Huntington Beach and Alamitos Heights crude, 14 to 32.9 gravity, inclusive; Richfield, Olinda-Brea and Fullerton, 14 to 30.9 gravity; Torrance and Inglewood, 14 to 28.9 gravity.

Column 2—Whittier crude, 14 to 32.9 gravity; Coyote Hills, 14 to 30.9 gravity.

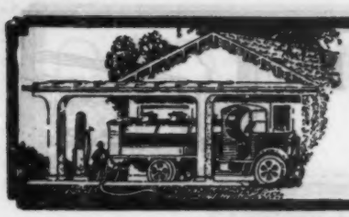
Column 3—Kern River, Newhall and McKittrick, 11 to 13.9 gravity; Midway-Sunset, Buena Vista and Elk Hills, 11 to 33.9 gravity; Lost Hills, 11 to 34.9 gravity; oil below 14 gravity posted at 50 cents.

Column 5—Price change posted by Standard of California September 16.

Column 6—Oil below 14 gravity posted at 45 cents.

Column 8—Posted by General Petroleum Co.

Kettleman Hills—Union Oil Co., September 22, 35 to 39 gravity, $1.10; 40 to 44 gravity, $1.20; 45 to 49 gravity, $1.35; 50 to 54 gravity, $1.50; 55 gravity and above, $1.65. Standard Oil Co. of California, 55 gravity and above, $1.65.



TANK WAGON MARKETS

Tank wagon quotations for gasoline and kerosene in United States as furnished by the larger marketing concerns Mar. 3

ALL TANK WAGON AND SERVICE STATION QUOTATIONS INCLUDE TAXES

STANDARD OIL CO. (INDIANA)

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Chicago*	14.0	15.0	3.0	11.0
Decatur, Ill.	16.4	17.4	3.0	11.0
E. St. Louis	15.7	14.7	3.0	10.2
Joliet	16.4	17.4	3.0	11.0
Peoria	16.4	17.4	3.0	11.0
Quincy	16.2	17.2	3.0	10.8
Davenport, Ia.	16.5	17.5	3.0	11.3
Des Moines	16.5	17.5	3.0	11.3
Keokuk	16.5	17.5	3.0	11.3
Sioux City	16.1	17.1	3.0	10.9
Duluth, Minn.	17.5	18.5	3.0	11.9
Mankato	16.0	16.0	3.0	11.7
Minneapolis	17.2	18.2	3.0	11.9
La Crosse, Wis.	16.2	17.2	3.0	12.0
Milwaukee	16.1	16.1	3.0	10.9
Madison	15.3	16.2	3.0	11.1
Detroit, Mich.	16.8	16.8	3.0	12.7
Grand Rapids	16.7	17.7	3.0	12.6
Saginaw	16.9	17.9	3.0	13.8
Evansville, Ind.	17.1	18.1	4.0	11.9
Indianapolis	17.3	16.3	4.0	12.1
South Bend	17.4	18.4	4.0	12.3
Fargo, N. D.	16.0	17.0	3.0	13.9
Huron, S. D.	16.3	17.5	4.0	12.7
Sioux Falls	17.0	17.0	4.0	12.4
K. C., Mo.	15.9	16.9	3.0	9.6
Springfield†	15.9	16.9	3.0	10.5
St. Louis†	12.9	13.9	2.5	10.3
St. Joseph	15.5	16.5	3.0	10.1
Wichita, Kans.	14.8	13.8	3.0	9.8
Bartlesville, Ok.	15.5	18.5	4.0	9.5

*Effective February 17, discounts on Q.D.A. in Chicago district 2 cents off service station price on purchases of 500 gallons and over; and 4 cents off service station on purchases of 1,000 gallons or more per calendar month.

†State tax 2 cents; remainder city tax.

Effective August 5, the following quantity discounts from the service station prices are allowed on monthly sales of gasoline: 500 gallons or more, 2 cents; 75,000 gallons or more, 4½ cents. Discounts are allowed each month and they are not cumulative. Delivery tickets showing date and quantity delivered must be sent to the seller before the tenth of the month to secure the discounts on the previous month's purchases.

PACIFIC COAST TERRITORY

Standard Oil Co. (California)

	Gasoline			Kero.
	Wh'le'e price	Retail price	Incl'ds tax of	tank wagon
Fresno	21.0	19.0	3.0	17.0
San Francisco	21.0	19.0	3.0	15.5
Los Angeles	20.5	18.5	3.0	15.5
Reno, Nev.	22.0	20.0	4.0	19.0
Portland, Ore.	22.5	22.5	4.0	16.5
Seattle, Wash.	21.5	21.5	3.0	16.5
Tacoma	21.5	21.5	3.0	16.5
Spokane	22.0	22.0	3.0	20.5
Phoenix, Ariz.	20.5	23.5	5.0	20.0

Above prices are at company's plant or depots as company does not operate stations. A 4-cent per gallon discount is given dealers and customers taking tank wagon lots except in Phoenix where the discount is 3 cents plus a 2-cent special temporary discount subject to withdrawal at any time.

SOUTHERN DISTRICT

Standard Oil Co. (Kentucky)

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Atlanta, Ga.	20.0	22.0	6.0	13.5
Augusta	20.0	22.0	6.0	16.5
Macon	20.0	22.0	6.0	13.0
Savannah	20.0	20.0	6.0	13.0
Birm'ham, Ala.	19.0	21.0	5.0	15.0
Mobile	19.0	21.0	4.0	15.0
Montgomery	19.0	21.0	4.0	15.5
Clarks'le, Miss.	18.0	20.0	5.0	13.5
Jackson	18.0	20.0	5.0	13.5
Natchez	18.0	20.0	5.0	13.5
Gulfport	16.0	16.0	5.0	13.5
Vicksburg	18.0	18.0	5.0	13.0
Jack'ville, Fla.	19.0	21.0	6.0	14.0
Miami	20.0	22.0	6.0	14.0
Pensacola	20.0	22.0	6.0	13.5
Tampa	19.0	21.0	5.0	13.0
Lexington, Ky.	17.0	18.0	5.0	14.5
Covington	17.0	18.0	5.0	13.5
Louisville	16.0	18.0	5.0	11.0
Ashland	17.0	19.0	5.0	13.0
Paducah	17.0	19.0	5.0	13.0
Bowling Green	19.0	21.0	5.0	14.5
Corbin	18.0	19.0	5.0	15.0

In addition to the state tax of 4 cents on gasoline, Montgomery has city tax of 1 cent on gasoline and one-half cent on kerosene. Kerosene prices in Georgia include 1-cent tax. In Florida, an inspection fee of 0.125 cent; in Alabama, an inspection fee of one-half cent on kerosene and one-fourth cent on gasoline. To Pensacola, Montgomery, Birmingham and Mobile state taxes add 1-cent levy tax. To Gulfport state tax add privilege tax of 2 cents.

Effective April 2, price to dealers 2 cents under posted tank wagon price.

ATLANTIC COAST DISTRICT

Standard Oil Co. (New Jersey)

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Atl'tic City, N.J.	14.5	16.5	3.0	11.5
Newark	13.5	15.5	3.0	10.5
Annapolis, Md.	16.0	17.0	4.0	11.0
Baltimore	15.2	16.2	4.0	9.5
Cumberland	17.0	18.0	4.0	13.0
Wash'gton, D.C.	13.7	14.7	3.0	10.7
Danville, Va.	17.8	18.8	5.0	11.8
Norfolk, Va.	16.3	17.3	5.0	10.0
Petersburg	17.3	18.3	5.0	11.3
Roanoke	18.0	18.0	5.0	12.0
Richmond	16.7	17.7	5.0	10.7
Charles'n, W.Va.	16.5	17.5	4.0	11.5
Keyser	17.1	18.1	4.0	12.0
Parkersburg	15.2	16.2	4.0	10.2
Wheeling	16.4	17.4	4.0	11.4
Charlotte, N. C.	18.3	19.3	5.0	13.3
Hickory	18.0	19.0	5.0	13.0
Mt. Airy	18.5	19.5	5.0	13.5
Salisbury	18.5	19.5	5.0	13.5
Charleston, S.C.	17.3	18.3	6.0	10.3
Columbia	19.2	20.3	6.0	12.3

Effective February 26, Standard Oil Co. of New Jersey has increased its dealer and commercial account discounts 1 to 3 cents per gallon in Maryland.

A 2-cent per gallon discount off the gasoline tank wagon price is offered to dealers.

CENTRAL SOUTH DISTRICT

Standard Oil Co. (Louisiana)

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
N. Orleans, La.*	16.5	17.5	6.0	13.0
Baton Rouge	17.5	18.5	5.0	13.0
Alexandria†	18.5	19.5	6.0	13.0
Lafayette*	18.5	19.5	6.0	13.0
Lake Charles*	18.5	19.5	6.0	13.0
Shreveport	17.5	18.5	5.0	13.0
Knoxville, Tenn.	20.0	21.0	5.0	15.0
Memphis	17.0	18.0	5.0	12.5
Chattanooga	18.5	19.5	5.0	13.0
Nashville	18.0	19.0	5.0	15.0
Bristol	20.0	21.0	5.0	14.0
Lt. Rock, Ark.	18.5	19.5	6.0	12.0

*Includes city tax of 1 cent. Louisiana kerosene prices include 1-cent state tax. New Orleans kerosene price also includes 1-cent city tax.

†Gasoline price at Alexandria includes 1-cent tax in Parish of Rapides.

Two-cent discount off gasoline tank wagon price to dealers and commercial accounts.

PENNSYLVANIA-DELAWARE AND PART OF NEW ENGLAND

Atlantic Refining Co.

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Pittsburgh, Pa.	14.0	19.0	...	12.0
Philadelphia	14.0	19.0	...	12.0
Scranton	14.0	19.0	...	12.0
Allentown	14.0	19.0	...	12.0
Altoona	14.0	19.0	...	13.0
Erie	14.0	18.0	...	11.0
Dover, Del.	17.0	19.0	3.0	12.0
Wilmington	17.0	19.0	3.0	12.0
Springf'd, Mass.	17.5	19.5	3.0	10.0
Worcester	17.3	19.3	3.0	10.0
Boston	14.5	16.5	3.0	10.0
Providence, R.I.	12.7	14.7	3.0	10.0
Hartford, Conn.	17.5	19.5	3.0	10.0
New Haven	17.6	19.6	3.0	10.0

*Includes tax of 3 cents. Pennsylvania tax is collected by the dealer and paid by him direct to the State. Atlantic Refining Co. recognizes a 2-cent per gallon discount on gasoline from its posted tank wagon markets on sales to dealers for purposes of resale. Atlantic Refining Co. also recognizes a maximum discount of 3 cents per gallon on gasoline to commercial accounts under contract for one year.

NEBRASKA

Standard Oil Co. (Nebraska)

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Omaha	17.25	18.25	4.0	11.25
McCook	18.75	20.75	4.0	13.75
Norfolk	17.25	17.25	4.0	11.75
N. Platte	18.75	20.75	4.0	13.50
Scottsbluff	18.75	20.75	4.0	12.25

OHIO

Standard Oil Co. (Ohio)

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Ohio points*	16.0	17.0	4.0	†13.0

*Dealers and commercial accounts 2 cents under tank wagon.

†Service station price 14 cents.

ROCKY MOUNTAIN DISTRICT

Continental Oil Co.

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Denver, Colo.	13.0	16.0	4.0	13.5
Pueblo	14.0	17.0	4.0	13.5
Grand Junction	18.0	19.0	4.0	17.0
Casper, Wyo.	17.0	20.0	4.0	13.0
Cheyenne	18.0	19.0	4.0	13.5
Butte, Mont.	19.0	22.0	5.0	18.0
Billings	20.0	23.0	5.0	16.5
Great Falls	20.0	23.0	5.0	18.0
Helena	20.0	23.0	5.0	18.0
Salt Lake, Utah	19.0	22.0	3.5	17.0
Albu-que, N. M.	16.0	20.0	5.0	14.0
Boise, Idaho	22.5	....	5.0	19.0
Twin Falls*	22.5	....	5.0	19.0

*Two and one-half cents off tank wagon to dealers at time of delivery.

STANOLIND FURNACE OIL IN CHICAGO

Less than 100 gallons	9.0
100 to 349 gallons	8.0
350 gallons or more	7.5

Note—Outside Chicago furnace oils discount of 1 cent per gallon is given on deliveries of 100 to 349 gallons and 1½ cents on deliveries of 350 gallons or more.

NAPHTHA

	Tank wagon	Tank car
Oleum spirits	12.0	9.0
V.M.&P. naphtha	14.0	9.5
Cleanors' naphtha	16.2	11.0
Stanisol	16.2	11.0

Tank wagon prices f.o.b. Chicago; tank car prices f.o.b. Whiting.

SOUTHWESTERN DISTRICT

Magnolia Petroleum Co.

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Dallas, Tex.	15.0	18.0	4.0	11.0
Fort Worth	15.0	18.0	4.0	10.0
Houston	15.0	19.0	4.0	11.0
San Antonio	15.0	19.0	4.0	10.0
El Paso	16.0	20.0	4.0	12.0
Texarkana	17.0	17.0	4.0	11.0
Muskogee, Ok.	12.0	15.0	4.0	9.0
Okla. City	12.0	15.0	4.0	10.0
Tulsa	12.0	15.0	4.0	10.0
Ft. Smith, Ark.	17.5	18.5	5.0	12.0
Little Rock	18.5	19.5	5.0	12.0

One-cent rebate made from posted station prices to cash purchasers in Louisiana, Arkansas and Tennessee.

NEW YORK AND PART OF NEW ENGLAND DISTRICT

Standard Oil Co. (New York)

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Albany, N. Y.	16.6	17.6	3.0	15.6
New York*	15.3	15.3	3.0	14.3
Buffalo	15.8	15.8	3.0	14.8
Rochester	16.0	16.0	3.0	14.0
Syracuse	16.8	16.8	3.0	14.8
Boston, Mass.	15.5	15.5	2.0	13.5
Augusta, Me.	18.8	18.8	4.0	14.8
Manch'tr, N. H.	18.4	18.4	4.0	14.0
Burlington, Vt.	19.3	19.3	4.0	15.3

*Prices in steel barrels.

TANK WAGON CHANGES

Magnolia Petroleum Co., effective February 28, posted tank wagon price of 12 cents and service station price of 15 cents in Oklahoma. This represented a cut of 3 cents at Muskogee, a cut of 2 cents at Oklahoma City and Tulsa, in the tank wagon market, and a reduction of 3 cents at Muskogee, 2 cents at Oklahoma City and Tulsa in service station prices. February 23, Standard of Louisiana advanced tank wagon and service station prices 1 cent at Knoxville, Tenn. Standard of Kentucky on February 25 reduced the posted prices on tank wagon and service station to 18 and 19 cents, respectively.

Continental Oil Co., effective February 25, advanced tank wagon price 1 cent to 13 cents at Denver, Colo., the service station posting moving up 2 cents to 16 cents. Standard Oil Co. of California cut the retail price 2 cents February 25 at San Francisco, Los Angeles and Fresno, making the new prices 19 cents, 18.5 cents and 19 cents, respectively.

In Arkansas the service station prices were advanced 2 cents by all companies, following the 1-cent increase in the state gasoline tax February 26, which is now 6 cents.

HEAR SINCLAIR PETITION

OKLAHOMA CITY, Okla., Mar. 3.—The Corporation Commission is considering the petition of the Sinclair Oil & Gas Co. for an increase in Oklahoma City production to more than 175,000 bbls. per day, the company claiming that there is a market for that quantity of Oklahoma City crude. The company claims it has a potential production in the pool of over 142,000 bbls. per day, based on the estimate of 2,000,000 bbls. per day as the potential for the whole field, that its potential represents 7.1219 per cent of the whole and prays that it be permitted to take 7.1219 per cent of 175,000 bbls. or more, or in excess of 12,600 bbls. per day.

Testimony for and against the granting of the petition was heard on Monday and today.

CRUDE OIL PRICES

(Continued from Page 189)

panies posted Grass Creek light and Elk Basin. Lost Soldier posted by Producers & Refiners Corp. Artesia posted by Ohio Oil Co. and Continental Oil Co. Latter company posted 50 cents per barrel January 1, 1931. Border and Red Coulee posted by Imperial Refining Co.

SOUTH CENTRAL AND SOUTHWEST TEXAS

Darst Creek (Oct. 28, 1930)*	$0.90
Luling (Oct. 28, 1930)†	.75
Mirando (Jan. 14)*	.49
Petrus (Oct. 28, 1930)*	1.10
Salt Flat (Oct. 28, 1930)*	.90
Thrall‡	..
Lytton Springs (Lockhart) See gravity table	
Dobrowolski (Oct. 25, 1930)‖	..
Same as Mid-Continent gravity scale up to and including 38-38.9° at	1.01
Somerset (Oct. 25, 1929)¶	..
Same as Mid-Continent gravity scale up to and including 38-38.9° at	1.01

*Posted by Humble Oil & Refining Co. and Magnolia Petroleum Co. †Magnolia Petroleum Co., Humble Oil & Refining Co., Crown Central Pipe Line Co. ‡Thrall prices same as North Central Texas less 19½ cents per cwt. freight. §Grayburg Oil & Refining Co., Pioneer Oil & Refining Co. and Texas Petroleum Products Co. ‖Pioneer Oil & Refining Co.

EASTERN STATES

Joseph Seep Purchasing Agency
(Effective Nov. 12, 1930)

Penna Grade Oil in National Transit Lines (Pennsylvania)	$1.85
Penna Grade Oil in Southwest Pennsylvania Lines (Pennsylvania)	1.80
Penna Grade Oil in Eureka Pipe Line Lines (West Virginia)	1.70
Penna Grade Oil in Buckeye Pipe Line Lines (Ohio) (Sept. 14, 1930)	1.45
Corning Grade Oil in Buckeye Pipe Line Co.'s Line (Dec. 31, 1930)	1.15
Ragland Grade Oil in Cumberland Pipe Lines (Kentucky)	1.10
Wayne District Oil in Cumberland Pipe Lines	1.17

Tide Water Pipe Co.

Bradford district (Nov. 12, 1930)	$2.15
Allegany district (Nov. 12, 1930)	2.15

Pure Oil Co.

Cabin Creek, W. Va. (Nov. 13, 1930)	$1.70
Kelly Creek, W. Va. (Nov. 12, 1930)	1.70
Bradford Hollow, W. Va. (Nov. 12, 1930)	1.70

MIDDLE WESTERN STATES

Ohio Oil Co.
(Effective Oct. 28, 1930)

Lima	$1.10
Wooster	1.40
Illinois	1.30
Indiana	.97
Princeton	1.30
Plymouth	.89
Western Kentucky	1.15
Midland, Mich.*	1.10
Dundee, Mich. (Oct. 26)†	..
	....Same as Mid-Continent gravity scale
Upper and Lower Traverse Sands, Mich. (Oct. 28, 1930)†	..
	....Same as Mid-Continent gravity scale
Cumberland, Clay, Barren, Clinton and Monroe Counties, Kentucky (Oct. 28)‡	.85
Oil City, Ky.§ (Jan. 14)	.80
Oil Springs (Canada) (Oct. 28)¶	1.67
Petrolia (Canada) (Oct. 28)¶	1.50
Alberta (Canada)‖:	
50° and above	2.71
45 to 45.9	2.17

*Posted by Pure Oil Co. †Posted by Standard of Indiana for boat shipment. ‡Posted by Paragon Development Co. §Posted by Stoll Refining Co. ¶Posted by Imperial Oil, Ltd. ‖Posted by Imperial Oil, Ltd., and Regal Oil & Refining Co. of Calgary.

MEXICAN CRUDE

Panuco*	$0.56

*F.o.b. ship, based on January transactions and exclusive of taxes and bar dues.

REPRESSURING OF INDIVIDUAL WELLS

(Continued from Page 38)

wells which otherwise would have had to have been pumped has reduced that gas-oil ratio to a more normal figure of around 250 feet per barrel.

Elimination of Pumping

In the elimination of pumping with its handicaps, the lift system has proved of essential benefit. By use of the gas, lifting costs on wells affected at Hankamer have been reduced to a very small figure. The gas, which formerly had no other use, is available and is being injected without compressors, thus not involving any expense of boosting. This does not take into consideration the greater efficiency of flowing wells over the original pumping operation.

In each of the two hook-ups, connections are made directly off the well heads through 2-inch lines to the lift wells. In the first, the gas is being injected into No. 1 Boyt through the tubing and out the casing. In flowing Nos. 5 and 6 off No. 8, the gas injection is reversed, that is, it is put down through the casing and then out the tubing.

Hankamer, a Gulf Coast Field, was discovered by geophysical exploration during 1928. Although generally supposed to be a salt dome, no cap rock or salt has been found. Gulf Production Co. owns the entire acreage and is the sole developer. So far the production has been confined to the Boyt tract in the H.& T.C. Survey No. 22 (Amos Allen). The first producer, No. 1 Boyt, was brought in June 6, 1929, and since then there has been a steady, conservative development of the producing area. With the exception of three deep tests, all of which were drilled a considerable distance from the pool as flank tests, there have been no failures.

The field has been marked by absence of gas pressures. Although a gas blowout was experienced in the second Boyt test at 3,692 feet, this hole was plugged to 2,925 feet, and the two gas wells, Nos. 7 and 8, were not brought in until July, 1930, more than a year after the opening of the field. That accounts for the fact that no flowing efficiency measures were undertaken until late in 1930. The two gas wells, the only ones in the field, are from deep sands at 4,120 and 4,262 feet, respectively. The former made an initial flow at the rate of 300 bbls. of oil daily and the latter 1,000 bbls. daily, but this production failed to hold. As previously stated, a total of 11 wells, all producers, have been completed in the field.

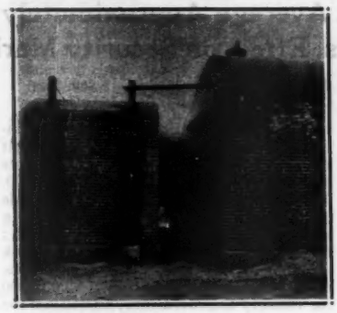
INTERNALLY FIRED STILLS USED IN CALIFORNIA

(Continued from Page 48)

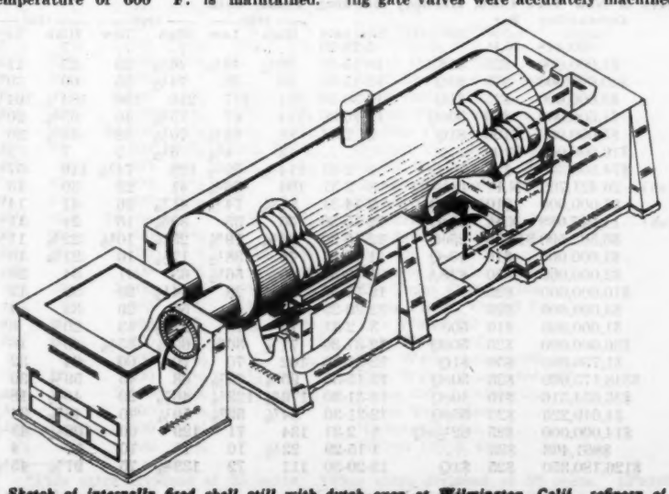
age and are later blended to meet market requirements.

The residue from the three stills flows by gravity to the fourth still where a temperature of 600° F. is maintained. The vapors from this still are fractionated in the fourth tower. The overhead stream is kerosene and from the base, a gas oil cut is taken.

With a 28 A.P.I. gravity crude oil, the company secures a 30 per cent yield of gasoline meeting U. S. Motor specifications. The kerosene cut averages 4 per cent, gas oil 10 per cent and the remainder is a 17 gravity product meeting bunker C specifications. The gas oil is used as charging stock for two cracking units which are in operation at the Western refinery.



View showing connection between dutch oven and still.



Sketch of internally fired shell still with dutch oven at Wilmington, Calif., refinery of the Western Oil & Refining Co.

SPECIAL VALVES MET NEW DRILLING METHODS

(Continued from Page 40)

with experiences. Designs and mechanisms to withstand the passage of sand, mud and cement under extreme pressures and velocities constituted the principle difficulties. Valve manufacturers were successful to a high degree and the co-operation given by engineers, field superintendents and others is of inestimable value. All worked for the good of the industry as is usual in this great undertaking. Perhaps Rotary secured its original thought for its slogan of "Service Above Self" from the oil and gas men. To make valves capable of handling the vast amount of rough, cutting sand and mud, and yet remain gas tight is indeed an accomplishment.

Great credit is due those responsible for handling these wells. Keen foresight and judgment were shown and the small number of wells lost is a fine measure of the abilities of those in charge of this important task.

As to designs used by the several manufacturers, we have only touched upon that point which had to do with the long tapering approach to the diameter of the pipe casing. Many other points of design tended to make possible this success. There had been developed excellent metal gaskets for the joint between the body and the bonnet. Later the development of the gasketless type met with a great degree of success.

The guides in the bodies of these drilling gate valves were accurately machined and the wedges fitted closely on the guides which materially reduced the drag over the seats. This fitting and adjustment served to take the pressure off the downstream side almost immediately the wedge disc left the seat. The thrust on the disc due to velocity was taken up in the guide, making for much better alignment and a decided reduction in frictional resistance.

The Acme standard thread was almost universally adopted and having stood the test of many years' service, there seems to be little question of continuance of that method.

Stable Supports

We have previously mentioned the extensions which provide a means of keeping the men farther away from the top of the casing during the opening or closing operations. This was accomplished by means of a universal joint. In some cases insufficient care was taken to relieve the stem of the weight of this pipe. The pipe was carried great distances without any under-supports. Naturally, this put an undue strain on the stem as well as the packing and in some cases the extreme angle of the pipe to the stem was such as to increase materially the force necessary to open or close the valve. In most cases this was quickly discovered and means were taken to support the pipe. Where this method is deemed advisable it is well to construct stable supports close to the stem at frequent intervals, and especially at the point where the force of tongs is applied.

The stems, as heretofore mentioned, were for the most part of very high grade stainless steel. The threads were accurately cut and fitted and some device for scraping and cleaning the thread ahead of the wedge nut or bushing was developed during the progress of this tremendous drilling program. The stems were turned with large integral collars which serve the double purpose of forming the thrust bearing together with a packing collar which, in either open or closed position, prevented the well pressure from coming upon the stuffing box and fiber packing. It was possible through this construction to greatly lessen the friction of packing on the stem and practically eliminate leakage occurring at this point.

The stems were ground to size and heat treated. This same heat treatment was given the bonnet bolts which were in fact not forged bolts but alloy steel bars made in the form of studs. The threads were accurately cut and fitted to the nuts and all of them were heat treated. Their tensile strength is 125,000 pounds and upward per square inch. That the factors of safety were ample at this point is best evidenced by the fact that no gaskets were "blowed." In cases where destruction tests were resorted to in the factories during development work, 10,000 and 15,000 pounds per square inch was not unusual.

Great improvements have been made in method and manner of threading the ends of the valves and extreme accuracy has been attained. We have witnessed tests in which these valves have been screwed on by hand only and pressures of 1,000 pounds applied without leakage. Many valves were used on several wells and in many cases the mistake was made of screwing these valves onto the casing entirely too tight. With reference to overhauling these valves for the second and third wells it was quite evident that the valves had been put on the casing without sufficient lubrication on the threads. This made it necessary to destroy the valve bodies in some cases and in others it was at least necessary to cut the nipples out instead of being able to screw them out of place.

Handled With Care

While practically all manufacturers provided means of keeping dirt out of the valves during shipment and storage, in several cases of carelessness in handling by truckers the threads were damaged and considerable amount of sand and grit was found in the valves before applying them to the casing. These careless practices were corrected as the work progressed and they were not so noticeable toward the slowing down of the field as they were in the rush time. The drilling gates began to be recognized as a rather intricate piece of machinery rather than a rough casting that might be thrown about and roughly handled, and greater care was evidenced as the field progressed.

When the product leaves the manufacturers' hands the valve is closed, and the ends are properly plugged. Where care is taken in removing the plugs and the valves are not opened before being applied to the casing, they will be tight and perform quite satisfactorily. Those in charge of the wells have endeavored to instill better practice in this regard, and better results are quite noticeable.

Added to all of the natural problems of the high production and terrific pressures arising from the deep sands came the necessity for proration which called for very definite and adequate means of shutting in all of these big wells during long periods. Methods of accomplishing this were almost altogether the problems of the men on the ground, with what assistance the manufacturers could give them with special connections.

A great many special fittings which reduce the number of joints on the flow lines were developed and the danger from leaking joints was greatly reduced. Some manufacturers brought out equipment wherein the lead lines could be completely connected up and wells could be bailed in with all the connections made except the upper blow-off valve. This made it possible to close the main gate valve, place the upper blow-off valve in position and immediately open the main valve with all other valves wide open, and permit the wells to flow. The ingenuity of the field operations was quite noticeable in the construction of Christmas tree and other detail hookup, some of which we are able to illustrate.

The gate valve manufacturer has kept his product abreast of the times. For each demand from the field, he has responded with a product that complies with requirements yet which holds in reserve ample strength to act as safety precaution. Designs are continually being improved. The future demands and needs of the industry are being anticipated. The gate valve manufacturer is ready for the deep well, high pressure, and bigger flow whenever the industry is in position to go still farther into the earth to secure the oft referred to "Golden Flow."

Sinclair Surveying For Pipe Line From Texas to Oklahoma

NEW YORK, Mar. 2.—Sinclair Consolidated Oil Corp. is contemplating the construction of a crude oil pipe line from Rusk County, East Texas, to a point in Oklahoma where it can tie in with the company's present line from the Oklahoma City Pool to Coffeyville, Kans. The inquiry which the company has put out for 35,000 tons of steel pipe, 12 inches in diameter, is calculated to provide for a line 265 miles in length.

In a temporary arrangement with the Prairie Pipe Line Co., Sinclair has filed a joint tariff from the latter's Cobb station, Kansas, to East Chicago, Ind., where a large Sinclair refinery is located.

Sinclair also has another pipe line project in contemplation, dependent upon the progress of the Rusk County development. This line would extend from the East Texas area to the company's refinery and terminal at Houston. The company is at present purchasing an average of 7,000 bbls. daily of Rusk County crude, its takings being limited to the tank car movement.

TWO DRILLERS KILLED

GRAHAM, Tex., Feb. 28.—Joe E. Rider and Jim Price, drillers, were killed when a well blew in and caught fire near Graham on February 25. Rider is survived by his wife and one child, and Price is survived by his wife and two daughters.

Oil Industry 1930 Earnings Contrasted

Statements of 11 Companies Average Approximately 40 Per Cent of the 1929 Earnings. Effect on Security Market

By A. E. Mockler
New York Bureau, The Oil and Gas Journal

NEW YORK, Mar. 2.—Net earnings of the American petroleum industry for 1930 will average approximately 40 per cent of 1929 earnings, if the statements of the first 11 companies in the industry to report for last year may be taken as a fair indication of the showing of the industry as a whole. Earnings of these 11 companies for the past year aggregated $71,795,173, as compared with net of $160,912,489 shown by the same group for 1929.

Earnings reports of these companies for 1930, with comparisons for the previous year, follow:

Company—	Net after all charges 1930	1929
Tide Water Assoc.	$8,750,914	$14,000,689
Indiana Pipe	747,764	837,490
New York Transit	75,729	165,231
Northern Pipe	110,512	148,018
Humble	*12,000,000	32,535,080
Prairie Pipe	14,637,625	22,800,453
Texas Corp.	*15,000,000	46,516,072
Atlantic Ref.	†2,742,000	17,332,417
Sun Oil	7,745,484	8,242,492
Union Oil	9,604,997	15,019,635
Standard (Kansas)	380,145	1,512,912
Total	$71,795,173	$160,912,489

*Company estimate. †Preliminary.

The foregoing is a cross section of the industry, and gives what is considered in financial circles a fair indication of the showing as a whole for the past year, which marked a severe setback for the entire industry so far as earnings were concerned.

Unfavorable earnings statements are looked for from practically all of the major companies which have not yet presented their statements for 1930, and it is indicated few of them fared better last year than the companies whose reports have been made public.

While earnings from actual operations suffered last year, both in the case of producing companies, refining and marketing organizations and completely integrated units, the problem of inventory readjustment at the year-end added still further to the difficulties of the industry in making any kind of a favorable showing for the year. Some of the companies early in 1930 foresaw the growing depression in crude petroleum and refined products prices, and followed a policy of drastic inventory curtailment during the year. These companies necessarily fared better than their less fortunate competitors in readjusting their inventories at the year-end.

Curtailment in drilling operations on the part of many major units last year, as well as conservation in production of established producing properties, tended to curtail charges for both field operations and depletion.

While earnings reports for 1930 make a sorry showing when compared with 1929 returns, it should be borne in mind that the latter year was the banner year in the history of practically all of the major companies. In the case of many of the major units, it is expected that their earnings reports for 1930, when published, will show a close relationship to 1927 earnings, a year in which many of the large companies barely covered their dividend requirements, and in which some oil concerns were forced to draw on surplus to keep their dividend rates unchanged.

Unfavorable earnings on the part of many companies have depressed stock and bond prices of these units to extremely low levels, and it is believed a number of additional important acquisitions and consolidations will be witnessed during the current year. Large companies with heavy surplus holdings are now in position to purchase marketing, producing and refining properties at the lowest prices for many years past, and it is believed companies which have been considering expansion plans will go forward with these developments during 1931.

Atlantic Refining

Pamphlet report of Atlantic Refining Co. and subsidiary companies for year ended December 31, 1930, shows consolidated net profit of $2,742,688 after interest, depreciation, depletion, federal taxes, etc., equivalent to $1.02 a share (par $25) on 2,692,854 average shares of common stock outstanding during the year and $1.01 a share on 2,696,642 common shares outstanding at end of the year. This compares with net profit in 1929 of $17,332,417 equal after deducting $700,000 dividends paid on 7 per cent preferred stock, now retired, to $6.79 a share on 2,448,019 average shares of common stock outstanding during the year and $6.20 a share on 2,681,980 common shares outstanding at end of year.

"As evidenced in part by the increase of fixed assets shown on the balance sheet," states J. W. Van Dyke, chairman of the Atlantic Refining Co., "income avails were sufficient to permit normal investments for improvements and expansions aggregating $17,437,000. These include an extension of the crude oil pipe line from Midland, Tex., to a new producing field at Hobbs, N. M.; the building of two Diesel-electric tank ships of 82,000 bbls. and 117,000 bbls. cargo capacity, respectively; $3,091,000 for refinery improvements; $6,642,000 for marketing facilities in the United States; and $1,670,000 for similar purposes abroad. Few of these investments had opportunity to contribute appreciably to 1930 earnings."

Omitting the inventory write-down of $3,112,409, net profit of $5,855,000 after all other deductions was 58 per cent of the average of $10,137,084 for the previous five years, 1925-1929, inclusive.

Derby Oil

Derby Oil Co. and subsidiaries report for year ended December 31, 1930, net profit applicable to Derby Oil & Refining Co. of $671,975 after depreciation, depletion, federal taxes, minority interest, etc. This compares with $335,362 in 1929.

Pure Oil

Pure Oil Co. declared the dividend of $1.50 usually declared for this quarter of the year on the 5¼ per cent preferred stock, and the regular quarterly dividends of $1.50 on the 6 per cent preferred and $2 on the 8 per cent preferred. All are payable April 1 to stock of record March 10.

Lion Oil

Lion Oil Refining Co. reports for year ended December 31, 1930, net loss of $536,016 after interest, depreciation, depletion, etc., comparing with net profit of $1,184,478, or $4.39 a share, on 270,000 no-par shares of stock in 1929.

Associated Oil

Report of Associated Oil Co. and subsidiaries for year ended December 31, 1930, shows net profit of $7,215,284 after federal taxes, interest, depreciation and depletion, cancelled leases, etc., equivalent to $3.15 a share (par $25) on 2,290,412 shares of stock. This compares with $8,940,699 or $3.90 a share in 1929.

Net profit for quarter ended December 31, 1930, was $2,618,723 or $1.14 a share, against $3,628,477 or $1.58 a share in fourth quarter of 1929.

Tide Water Associated

Report of Tide Water Associated Oil Co. and subsidiaries for year ended December 31, 1930, shows consolidated net income of $8,750,914 after depreciation, federal taxes, minority interest, etc., equivalent after 6 per cent preferred dividends, to 76 cents a share on 5,739,258 no-par shares of common stock. This compares with $14,000,688, or $1.73 a share on 5,560,424 common shares in 1929.

The company paid two dividends of 30 cents each on the common stock in 1930. These dividends had been declared in December, 1929, and were charged against 1929 earnings.

Tide Water Oil

Report of Tide Water Oil Co. and subsidiaries for year ended December 31, 1930, shows net income of $2,368,842 after depreciation, depletion, federal taxes, etc., equivalent after 5 per cent preferred dividends, to 63 cents a share on 2,191,821 no-par shares of common stock. This compares with $6,187,724 or $2.36 a share on common in 1929.

Humble Oil

Directors of the Humble Oil & Refining Co. declared its regular quarterly dividend of 50 cents a share, payable April 1 to stockholders of record March 2.

Sun Oil

Statement of Sun Oil Co. and subsidiaries as of December 31, 1930, shows total assets of $94,140,681, comparing with $88,473,366 on December 31, 1929, and surplus of $10,605,255, against $9,136,518. Current assets totaled $26,073,171 and current liabilities $10,157,097, comparing with $29,552,615 and $9,569,184, respectively, at close of preceding year.

Pacific Western Oil

Pacific Western Oil Corp. reports for year ended December 31, 1930, net profit of $2,316,544 after interest, depreciation, depletion, abandoned leases, federal taxes, etc., equal to $2.32 a share on 1,000,000 no-par shares of capital stock. This compares with $1,816,985 or $1.82 a share in 1929.

South Penn Oil

South Penn Oil Co. declared a quarterly dividend of 25 cents, payable March 31 to stock of record March 14, placing the stock on $1 annual basis against $2 previously.

Standard Oil of Kentucky

Standard Oil Co. of Kentucky has de-

(Continued on Page 196)

STANDARD OIL STOCKS ON NEW YORK CURB

Quotations Compiled by Francis, Bro. & Co., Associate Members of New York Curb, Kennedy Building, Tulsa, Okla.

1931 High	1931 Low	Week ended February 28 Sales	High	Low	Close	Stocks—	Outstanding capital	Par value	Div. rate	Last paid	1928 High	1928 Low	1929 High	1929 Low	1930 High	1930 Low
½	⅛	100	⅛	⅛	⅛	Atlantic Lobos	499,448	N.P.	....	5-28-30	..	..	..	..	1	¼
12⅞	10	100	10	10	10	Borne Scrymser	$1,000,000	$25	$18A	10-15-30	56½	44½	46½	25	25	11¼
48	40	x100	48	48	48	Buckeye Pipe Line	$10,000,000	$50	$1Q	12-15-30	76	53	74½	55	69	39⅞
125	110	100	125	125	125	Chesebrough Mfg.	$3,000,000	$25	$1Q	12-30-30	161	117	210	130	184⅞	104¼
30	20⅝	100	25	25	25	Cumberland Pipe Line	$1,500,000	$50	50cQ	12-15-30	114	67	75¾	40	65¾	20¼
29¾	27	100	29¾	28	28	Eureka Pipe Line	$5,000,000	$100	$1Q	2- 2-31	88	64½	70½	42	54¾	26
2⅞	1⅞	200	2⅞	2	2⅞	Galena Signal Oil	$16,000,000	$100	....	.....	13	4¾	6½	3	7	2½
72	57⅝	1,300	65⅝	65	65	Humble Oil & Refining	$74,103,300	$25	50cQ	1- 2-31	114¾	59½	128	74⅛	119	57¼
18¼	16¾	300	17¼	17⅛	17⅛	Imperial Oil of Canada (sh)	26,421,768	N.P.	12½cQ	3- 2-31	104	56¾	41	22	30	15
21⅛	16	100	21⅛	21⅛	21⅛	Indiana Pipe Line	$3,000,000	$10	50cQ	2-14-31	91⅞	74⅜	41⅞	26	41	14½
15½	13⅛	2,200	14¼	14¼	14¼	International Petroleum (sh)	14,247,088	N.P.	25cQ	12-15-30	55	35	30⅜	15	24	11⅝
14	12¼	100	13½	13½	13½	National Transit	$6,362,500	$12.50	25cQ	12-15-30	82⅝	19⅜	25½	10⅛	22⅜	11½
14½	10¼	100	10¼	10¼	10¼	New York Transit	$1,000,000	$10	40cQ	1-15-31	75	38½	17½	10	21⅜	10⅛
30	28	200	30	30	30	Northern Pipe Line	$2,000,000	$50	$28A	1- 2-31	69	56½	63	41	54	26¼
15½	13⅛	200	15	15	15	Penn Mex Fuel	$10,000,000	$25	....	12,15-30	84	28	44½	20	32	12
7½	6	100	7	7	7	Solar Refining	$4,000,000	$25	....	12-20-29	..	..	50	29	33	4⅞
14	10	100	12½	12½	12½	Southern Pipe Line	$1,000,000	$10	50c	3- 2-31	19	15	22½	13	20⅞	8⅜
23⅞	19⅛	300	19¾	19⅝	19¾	South Penn Oil	$30,000,000	$25	50cQ	12-31-30	71⅞	36¾	60¼	35⅛	45⅞	16⅛
36	33	200	36	35¼	36	Southwest Pennsylvania Pipe Line	$1,750,000	$50	$1Q	12-31-30	102	70	70	60	64	32
38½	34½	5,600	35⅝	34⅝	35	Standard Oil of Indiana	$348,175,069	$25	50cQ	12-15-30	95⅞	70⅞	63	45	59⅞	30
23⅝	20⅝	800	23⅝	23	23	Standard Oil of Kentucky	$25,654,516	$10	40cQ	12-31-30	179¾	122¼	467⅛	29	40½	18⅝
36½	33⅛	300	34½	33⅛	33⅛	Standard Oil of Nebraska	$4,649,225	$25	50cQ	12-31-30	54⅞	39⅞	50¼	40	48⅞	34⅝
62½	49⅝	100	56	56	56	Standard Oil of Ohio	$14,000,000	$25	62½cQ	1- 2-31	134	71	129	60	108½	43¼
		No sales.				Swan-Finch Co.	$861,466	$25	....	1-15-29	23½	16	18	10	10	4
69⅞	52⅝	2,100	66	65	65⅝	Vacuum Oil Co.	$126,180,350	$25	$1Q	12-20-30	111	72	133¾	75	97⅞	45⅝

*Plus 50 cents extra. †Plus 10 cents extra. ‡Plus 25 cents extra. x Ex-dividend.

INDEPENDENT OILS ON NEW YORK CURB

Quotations Compiled by Francis, Bro. & Co., Associate Members of New York Curb, Kennedy Building, Tulsa, Okla.

1931 High	1931 Low	Week ended February 25 Sales	High	Low	Close	Stocks—		Outstanding capital	Par value	Div. rate	Last paid	1928 High	1928 Low	1929 High	1929 Low	1930 High	1930 Low
1	5/8	100	1	1	1	American Maracaibo	(sh)	700,000	N.P.	....	.....	9½	3⅛	8⅝	1⅛	4½	½
16⅞	14¾	200	14¾	14¾	14¾	British American (coupons)		1,311,321	N.P.	20cQ	1- 2-31	55	32¾	62	7⅞	23	13⅜
2⅜	½	600	1¾	1¾	1¾	Carib Syndicate		$131,250	25c	....	.....	4½	3⅞	4⅞	1	2¾	⅝
20¾	15	23,900	20⅛	19¼	19⅜	Cities Service	(sh)	24,290,359	N.P.	30cA†	3- 2-31	90⅞	54	68⅛	20	44¼	13⅛
84¾	79¾	300	84⅜	84¼	84¼	Cities Service pfd.	(sh)	1,500,000	N.P.	50cM	3- 2-31	103¼	94½	98¾	84	93⅞	78¼
½	1/16	2,200	⅜	1/16	1/16	Colombia Syndicate		$2,000,000	$1	....	.....	3¼	.76	2	½	¾	⅛
2¾	2	500	2	2	2	Consolidated Royal		$5,000,000	$10	7½cQ	1-25-31	8⅞	6¼	11⅛	2½	5⅞	2
3½	3⅛	1,800	3⅜	3⅛	3⅜	Creole Petroleum	(sh)	5,977,873	N.P.	....	.....	17½	9½	11¾	5⅝	7⅝	3
⅝	½	1,700	½	½	½	Crown Central		.....	....	....	.....	..	..	..	..	..	..
5	4	300	5	4½	5	Darby Petroleum		1,019,392	N.P.	....	10-15-30	33½	3¼	26	6½	21¾	4¼
6	2⅝	300	4¼	4¼	4¼	Derby Oil & Refining	(sh)	500,000	N.P.	....	.....	2¼	1	11	2	11	2
32½	30	175	32½	30	30	Derby Oil & Refining pfd.		48,500	N.P.	....	.....	21⅛	7½	44	20¾	60	30
75½	63¾	800	69⅞	69	69	Gulf Oil Corp.	(sh)	4,504,921	$25	37½cQ	1- 1-31	165	101⅛	209	115	166⅞	58½
⅝	⅜	800	½	7/16	1/16	Intercontinental Petroleum		$5,682,000	$5	....	.....	3⅜	1	2⅞	⅜	1¾	⅜
1⅞	⅝	500	1⅞	1½	1½	Kirby Petroleum	(sh)	750,000	N.P.	....	.....	3	1¼	3⅝	1¼	3	⅞
1	⅝	400	1	⅞	⅞	Leonard Oil & Development		$50,000,000	$25	....	.....	9⅜	5⅛	6⅛	1	4⅜	½
6¾	5⅝	100	6½	6½	6½	Lion Oil & Refining	(sh)	250,000	N.P.	....	10-27-30	43⅞	20	38⅞	18	29	4⅞
29	24	900	28	27¾	28	Lone Star Gas	(sh)	5,000,000	N.P.	25cQ	12-31-30	69⅛	48½	67⅞	28	55⅞	19⅝
⅜	¼	3,000	⅜	1/16	⅜	Magdalena Syndicate	(sh)	850,000	$1	....	.....	1⅞	½	1¼	¼	½	⅛
5	3	100	4	4	4	Margay Oil Corp.		160,000	N.P.	....	7-10-30	48½	32	38½	14	16	3
2⅝	1½	300	1⅝	1⅝	1⅝	Mexico-Ohio Oil Co.		500,000	N.P.	....	.....	8	2¾	6⅜	2¼	7½	1⅜
½	¼	400	¼	¼	¼	Mountain & Gulf		$4,000,000	$1	1½cQ	1-15-31	1¾	.76	1½	¼	⅝	⅜
5⅞	4⅜	400	5½	5½	5½	Mountain Producers		$1,682,182	$10	40cQ	1- 2-31	28⅞	19½	22⅞	7	12⅛	3⅜
1½	1⅛	100	1⅜	1⅜	1⅜	New Bradford Oil		$1,095,291	$5	10cQ	1-15-31	5⅝	4¼	5	2½	3½	1⅛
3	1⅞	100	3	3	3	New Mexico and Arizona		$1,000,000	$1	....	.....	11⅞	7⅛	9⅜	2¼	7¾	1½
3¼	1¾	300	3¼	2⅝	3¼	North Central Texas	(sh)	400,000	N.P.	....	9- 2-30	14¼	8½	18½	6⅛	11¾	2⅛
½	¼	500	1/16	⅜	1/16	Pandem	(sh)	489,875	N.P.	....	.....	6	2⅛	3½	⅛	2½	¼
2	1⅛	1,300	1⅞	1⅝	1⅞	Pantapec Oil	(sh)	1,506,000	N.P.	....	.....	15⅝	8½	10½	1⅞	4⅜	⅞
..	..	No sales.				Red Bank Oil	(sh)	250,000	N.P.	....	.....	18	4⅞	16	9⅝	10⅛	1½
1⅜	1	800	1¼	1⅛	1¼	Reiter-Foster	(sh)	388,584	N.P.	....	12- 2-29	12⅞	4⅛	8½	1⅛	5⅜	1
3	2	500	2½	2½	2½	Ryan Consolidated	(sh)	500,000	N.P.	....	.....	12	4⅛	11	3	8⅝	2
1⅜	1	100	1	1	1	Salt Creek Consolidated	(sh)	1,286,300	$10	10cQ	1- 2-31	7¼	5½	5⅞	1⅞	2½	½
7⅝	6⅛	100	7	7	7	Salt Creek Producers	(sh)	1,496,859	$10	50c	2- 2-31	35	23⅛	25⅞	9	15¼	5¼
..	..	No sales.				Savoy Oil		$750,000	$5	....	.....	3½	1	2½	1/16	1	½
5¼	2⅜	No sales.				Sunray Oil Corp.	(sh)	1,163,185	$5	5%Q‡	1-15-31	..	..	12	5⅝	10	2
1⅞	⅞	1,100	1⅛	1	1	Venezuelan Petroleum	(sh)	755,090	$5	....	2-15-30	9⅛	4¾	6½	1⅝	4½	⅜
3½	1½	100	3½	3½	3½	Woodley Petroleum		$500,000	$1	....	3-31-29	8¼	4⅞	9½	2	5	½
⅝	⅜	100	⅝	⅝	⅝	Y Oil & Gas		100,000	N.P.	....	.....	8⅜	2⅛	2⅞	½	2½	⅜

*Including one-half per cent monthly in stock. †Payable monthly and monthly stock dividend of one-half per cent. ‡Paid in lieu of regular cash dividend of 2 per cent. x Ex-dividend.

TRANSACTIONS IN OIL SHARES ON NEW YORK STOCK EXCHANGE

Quotations Compiled by Francis, Bro. & Co., Members of the New York Stock Exchange and Associate Members of New York Curb, Kennedy Building, Tulsa, Okla.

1931 High	1931 Low	Week ended February 25 Sales	High	Low	Close	Stocks—		Outstanding capital	Par value	Div. rate	Last paid	1928 High	1928 Low	1929 High	1929 Low	1930 High	1930 Low
21	17½	300	20	19¼	19¼	Amerada Corp.	(sh)	922,075	N.P.	50cQ	1-30-31	43⅞	27⅛	42⅝	17½	31½	16½
11½	7	200	10½	10½	10½	American Republics Corp.	(sh)	209,180	N.P.	....	.....	85	51⅛	64¾	12½	37	5⅛
31	26½	‖20	31	31	31	Associated Oil		$57,260,300	$25	50cQ	12-31-30	53⅜	37½	47¼	34½	51	30
23⅝	18	10,300	23⅜	22⅛	22¾	Atlantic Refining		$66,763,775	$25	25cQ	12-15-30	66⅜	50	77⅛	30	51⅜	16⅝
14⅜	11¼	6,200	14¼	13½	13⅝	Barnsdall Corp. A		$56,546,600	$25	50cQ	11- 6-30	54	20	49½	20	34	8⅝
12	9¼	4,800	11⅝	11	11⅛	Continental Oil of Delaware	(sh)	4,741,554	N.P.	....	.....	..	..	47⅞	18	30½	7¾
45⅛	24¼	2,400	42¾	41¾	41¾	General Asphalt	(sh)	413,333	N.P.	75cQ	12-15-30	94⅞	68	94¾	42¼	71½	22⅜
68½	35¼	7,800	66⅞	62	63¼	Houston Oil		$24,968,600	$100	....	.....	167	79	109	26	116⅞	29¼
14⅛	8¼	8,300	13⅞	12⅝	13⅜	Houston Oil (new)	(sh)	998,744	$25	....	.....	..	..	..	..	11¾	6⅝
4⅝	3⅝	1,400	4	3⅞	3⅞	Indian Refining		$12,564,070	$10	....	.....	39⅝	9	53	13⅛	17	2
4½	3¾	200	4¼	4⅛	4⅛	Louisiana Oil Refining	(sh)	1,190,063	N.P.	....	.....	19¾	9⅜	18	7	12	3½
3¾	2⅛	200	3¾	3½	3¾	Maracaibo Oil	(sh)	330,000	N.P.	....	.....	25½	12½	18½	5⅛	10⅜	1⅜
19½	10⅝	18,400	19⅝	18⅜	18⅜	Mexican Seaboard	(sh)	1,244,383	N.P.	....	10- 1-24	72	4⅝	59⅜	8¼	37	9¾
16⅜	13½	3,700	15⅜	14½	15¼	Mid-Continent Petroleum	(sh)	1,857,912	N.P.	50cQ	2-16-31	44½	25⅛	39⅞	22⅛	32	11
19½	15⅝	2,100	17¼	16⅝	17¼	Ohio Oil	(sh)	6,648,052	N.P.	25cQ	12-15-30	84	58½	79⅞	64¼	32	16
35⅛	34	100	35	35	35	Pan American P. & T.		$50,084,700	$50	....	12-20-27	50⅞	38¼	69	40½	46½	42
36½	32	100	35½	35½	35½	Pan American P. & T. "B"		$121,110,650	$50	....	12-20-27	59⅞	37¾	69¼	40½	67¼	30
4¼	2⅜	1,400	4¼	3¾	4	Panhandle P. & R.	(sh)	199,370	N.P.	....	.....	21¾	11½	15¼	3	12¾	1⅜
..	..	No sales.				Panhandle P. & R. pfd.		$2,564,400	$100	....	.....	108	70	76	47½	80	47½
16⅝	12¼	12,000	15⅛	14½	14½	Phillips Petroleum	(sh)	2,593,075	N.P.	50cQ	1- 2-31	53⅞	35¼	47	24¼	44⅜	11½
1	⅝	800	⅞	¾	⅞	Pierce Oil Corp.		$29,622,831	$25	....	.....	5¼	½	3⅜	1	2½	½
3⅛	1¾	4,700	3⅛	2⅞	3	Pierce Petroleum	(sh)	2,500,000	N.P.	10c	2-16-31	7	3½	5⅞	½	7⅛	1⅜
19¼	12¾	2,600	19¼	18½	18¾	Prairie Oil & Gas		$60,848,000	$25	50cQ	12-31-30	68	46	65⅜	40½	54	11¼
25½	17⅞	4,900	25⅜	24⅝	25	Prairie Pipe Line		$101,250,000	$25	75cQ	12-31-30	280	172	65	45	60	16⅝
5⅞	2½	100	4¾	4¾	4¾	Producers & Refiners		$37,438,950	$50	....	9-15-23	29⅞	16	25⅞	4	11⅞	1
15⅞	11⅞	‖140	15½	15½	15½	Producers & Refiners pfd.		$2,845,350	$50	....	5- 4-25	49⅝	41	46¾	25½	40	11½
11⅞	8¾	2,500	10½	10⅛	10⅜	Pure Oil		$75,959,250	$25	....	9- 1-30	31⅝	19	30¾	20	27¼	7⅝
6⅜	2¾	6,200	5	4¾	4¾	Richfield Oil (new)		$52,410,875	N.P.	....	.....	56	23	49⅝	20	9¾	4⅛
10¼	5⅜	2,500	9½	8⅝	8¾	Rio Grande Oil	(sh)	1,236,270	N.P.	....	7-25-30	37½	32	42½	15	25¾	5
42⅝	37¾	300	40⅝	40	40	Royal Dutch, N. Y.	(sh)	611,303	....	$1.3404	1-30-31	64	44⅝	64	43⅛	56½	36⅞
34	30½	‖190	34	32	32	Shell Transport & Trading Co.		£23,985,000	£1	$0.966	1-23-31	47⅞	41⅜	51½	40⅝	48⅜	26
10¼	7⅝	3,500	9⅝	9⅜	9½	Shell Union Oil	(sh)	13,066,497	N.P.	....	6-30-30	39¼	23¼	31⅝	19	25½	5¼
10¼	7¼	100	9¾	9¾	9¾	Simms Petroleum		$8,353,620	$10	....	9-15-30	27¼	18⅛	40⅛	15	37	5⅝
14⅝	10⅛	54,300	14⅝	13¼	14⅛	Sinclair Consolidated	(sh)	5,500,000	N.P.	25cQ	1-15-31	46⅜	17⅝	45	21	32	9¾
102¾	95	100	102¾	102¾	102¾	Sinclair Consolidated pfd.		$16,025,250	$100	$2Q	2-14-31	110	102½	111	103	112¼	86
12⅞	8½	2,400	10	9¼	9⅞	Skelly Oil		$27,441,250	$25	....	12-15-30	42⅝	25	40½	28	42	10⅛
51¾	45⅛	4,900	50½	49	49	Standard of California	(sh)	12,594,098	N.P.	62½cQ§	12-15-30	80	63	81⅞	51½	76	42¼
19	14⅝	400	17¼	17	17	Standard of Kansas		$8,000,000	$25	25cQ	12-15-30	37⅜	15	33¾	18	49	14⅜
52½	45¾	16,100	52	50⅜	50¾	Standard Oil of New Jersey		$634,999,200	$25	25cQ*	12-15-30	59⅜	37¾	83	49	84⅞	32½
26	22½	3,800	25½	25	25	Standard Oil of New York		$445,223,675	$25	40cQ	12-15-30	33¼	28¾	48⅛	31¾	40⅝	19⅜
45¼	39½	x100	45¼	45¼	45¼	Sun Oil	(sh)	1,416,869	N.P.	25cQ	12-15-30	77	31½	68⅝	55	70	39
1¾	¾	500	1¾	1½	1½	Superior Oil Corp.	(sh)	776,979	N.P.	....	12-20-30	..	..	24	5¾	9⅜	¾
36¼	30⅛	5,100	35¼	34⅜	34⅝	The Texas Corporation		$246,204,900	$25	75cQ	1- 1-30	74¾	50	71⅞	50	60½	28¼
6½	4½	300	5¾	5¾	5¾	Texas Pacific Coal & Oil Co.		$9,304,890	$10	2½%A‡	12-31-29	26⅝	12⅛	23⅞	9½	14½	4
15	10½	300	13⅜	12⅞	13⅜	Tide Water Oil	(sh)	2,191,759	N.P.	20cQ	12-31-30	41½	19⅝	40	14	31	13
82	69¼	200	82	82	82	Tide Water pfd.	(sh)	19,947,000	N.P.	$1.25Q	2-16-31	100⅛	86	97½	85⅛	94⅞	71
9	6½	4,300	8¼	8⅛	8¼	Tide Water Associated	(sh)	5,566,424	N.P.	30c8A	2-16-31	25	14¾	23½	10	17¾	5⅞
68	55	100	66½	65½	66	Tide Water Associated pfd.		$73,284,500	....	$1.50Q	1- 2-31	..	..	90⅞	74⅛	89¾	55
26⅝	22	2,100	25⅞	24½	25¼	Union Oil of California		$104,342,375	$25	50cQ	2-10-31	58	42⅝	57	42⅛	50	20⅛
25¼	23	600	23½	23	23	Union Tank Car	(sh)	1,254,048	$100	40cQ	3- 2-31	128½	110	163¾	121⅞	38½	23
7⅝	4¼	500	6¼	6	6	Warner-Quinlan	(sh)	632,948	N.P.	....	7- 1-30	44⅞	26	42⅞	15	27	4¼
7¼	6½	200	7¼	7	7	Wilcox Oil & Gas	(sh)	428,907	N.P.	....	5-10-28	..	..	29¾	12⅞	21	6½

*Plus extra dividend of 25 cents. †Plus extra dividend of 50 cents. ‡Payable in stock. §Plus 2 per cent stock dividend. ‖Unit of trading less than 100 shares. x Ex-dividend.

In comparing highs and lows for the several years in the three tables, it will be necessary to take into consideration cases where there have been splits in the stock.

EAST CENTRAL TEXAS WILDCATS

(Continued from Page 69)

Hickman and Baird's No. 1 Maude Smith, 160 ft. from N and 160 ft. from E of 35-ac. tract, 3,200 ft. from W and 2,550 ft. from N of survey, Isaac C. Skillern Sur. ..... Derrick and moving in material.

Hurburt and Brown's No. 1 L. L. Mackey, 990 ft. from E and 990 ft. from S of 269-ac. tract, 1,000 ft. from W and 990 ft. from S of survey, G. Y. Chambers Sur. ..... Location.

Hurburt and Brown's No. 1 A. J. Page, 1,670 ft. S and 2,080 ft. E of SW cor. of Ed Robinson Sur., James Dixon Sur. ..... Drlg. 1,200 ft.

Lewis Prod. Co.'s No. 1 D. M. Peterson, 150 ft. from S and 150 ft. from W of survey, G. S. Carthews Sur. ..... Location.

Leonard Pet. Co.'s No. 1 W. S. Pryor, 200 ft. from S and 200 ft. from W of 162-ac. tract, 2,600 ft. from E and 2,350 ft. from N of survey, Hamilton McNutt Sur. ..... Derrick.

Lloyd Oil Corp.'s No. 1 S. G. Andrews, 150 ft. fom S, 330 ft. from W of NW 50-ac. tract, 3 miles NW of Kilgore, W. M. F. Hyde Sur. ..... Shut down 2,665 ft.

Magnolia Pet. Co.'s No. 1 Ben Laird, 150 ft. from E and 150 ft. from S of survey, Isaac Ruddle Sur. .... Location.

Magnolia Pet. Co.'s No. 1 B. Rodden, 200 ft. from N and 200 ft. from W of 42-ac. lease, 4,200 ft. from W and 6,200 ft. from N of survey, William Robinson Sur. ..... Location.

Magnolia Pet. Co.'s No. 2 B. Rodden, 500 ft. NE and 200 ft. SE of NW cor. of 42-ac. lease, William Robinson Sur. ..... Derrick.

Marine Oil Co.'s No. 1 Art Mitchell, 150 ft. from E and 150 ft. from S of lease, 1,050 ft. from E and 800 ft. from S of survey, John S. Carithers Sur. .... Derrick.

George McCamey et al's No. 1 J. F. Richards, 150 ft. from N and 150 ft. from W of 50-ac. tract, Mary Van Winkle Sur. ..... Shut down 3,473 ft.

Merren-Van Horn et al's No. 1 Maude Smith, 150 ft. from S, 150 ft. from W of 35-ac. tract and 10-ac. lease, 2,400 ft. from W and 2,800 ft. from N, Isaac C. Shelborn Sur. ..... Drlg. 1,110 ft.

Navarro Oil Co.'s No. 1 G. B. Tenery, 167 ft. from N and 150 ft. from W of farm and 10-ac. lease, 5,000 ft. from W and 4,550 ft. from N of survey, William Robinson Sur. ..... Building derrick.

W. G. Ray Drlg. Co.'s No. 1 Maude Smith, 150 ft. from N and 150 ft. from W of tract, 1,300 ft. from W and 1,400 ft. from S of survey ..... Rig up.

Foy Roberts et al's No. 1 L. M. Colburn, 150 ft. from E and 150 ft. from S of 45-ac. lease, 5,700 ft. from E and 850 ft. from N of survey, Henry Hathaway Sur. ..... Location.

C. Rosenfield et al's No. 1 J. A. Knowles, 700 ft. from E, 1,350 ft. from N, William Lyles Sur. ..... Derrick.

Jim Rusk et al's No. 1 G. B. Tenery, 110 ft. from N and 110 ft. from W of 10-ac. lease, 5,050 ft. from W and 49,010 ft. from N of survey, William Robinson Sur. ..... Derrick.

Selby Oil & Gas Co.'s No. 1 P. J. Snarley, 200 ft. from N and 200 ft. from E of survey, William Lyndale Sur. ..... Derrick pattern.

Simms and Stanolind Oil Co.'s No. 1 G. B. Tenery, 150 ft. from N and 150 ft. from W of 10-ac. lease, William Robinson Sur. ..... Derrick.

Smith Ref. Co.'s No. 1 J. A. Knowles, 150 ft. from S, 150 ft. from NW of 75-ac. tract, 5,200 ft. from W, 7,700 ft. from N, Mary Van Winkle Sur. ..... Derrick.

Sultan Oil Co.'s No. 1 J. F. Spangler, 330 ft. from E and 300 ft. from S of NE of 160-ac. tract, 2,600 ft. from E and 1,500 ft. from S of survey, G. W. Hooper Sur. ..... Derrick.

Paul Vitek et al's No. 1 Louise Osborne, 150 ft. from E, 150 ft. from S of W 46-ac. of 84-ac. tract, 2,000 ft. from W, 450 ft. from S, R. R. Bobbett Sur. ..... Derrick pattern.

Werbey and McMinn's No. 1 Solon King, 1,400 ft. from E and 3,300 ft. from S of survey, W. P. Chisum Sur. ..... Derrick.

P. H. Wilson's No. 1 M. Hill, 150 ft. from N and 150 ft. from E of 30-ac. tract, John Ruddle Sur. ..... Derrick pattern.

Youngblood, trustee's No. 1 W. N. Lamp, 300 ft. from S and E of most northern NW cor. of tract, 5,800 ft. from W, 1,500 ft. from N, David Ferguson Sur... Derrick pattern.

HENDERSON COUNTY

E. L. Chapman's No. 3 Cade, 1,650 ft. from N and 750 ft. W, J. B. Dorsey Sur. ..... Drlg. 4,650 ft.

HUNT COUNTY

Mamie S. Hammond's No. 1 W. H. Adams, center of survey, W of Branson Sur., J. A. McFarland Sur. ..... Derrick blew down.

LAMAR COUNTY

Everett & Allen's No. 1 Guest, 250 ft. S and 2,046 ft. E of 100-ac. tract, L. Roberts Sur. ..... Shut down 1,661 ft.

RED RIVER COUNTY

Droppleman and Bunely's No. 1 J. W. Cunningham, 250 ft. E and 250 ft. S of 180-ac. tract, S. B. Shi Sur. ..... Shut down 2,641 ft.

Everett & Allen's No. 1 E. Howison, 225 ft. S, 195 ft. W of 79-ac. tract, William Humphreys Sur. ..... Derrick.

Everett & Allen's No. 1 Bryan, 1,300 ft. SW of NE cor. of Bryan 130 acres, P. Vaughn Sur. ..... Location.

KILGORE AREA—RUSK COUNTY

H. L. Blackstock's No. 1 W. P. Brightwell, 150 ft. from N and 150 ft. from E of 100-ac. tract and 10-ac. lease, Robert E. Winn Sur. ..... Location.

Burton Drlg. Co.'s No. 1 Flores, 2,250 ft. from N, 150 ft. from W of SE cor., Peter Holmes Sur. ..... Drlg. 3,696 ft.

Burton Drlg. Co.'s No. 1 Clark, 172 ft. from E, 2,282 ft. S of Peter Holmes Sur. ..... Base Pecan Gap 3,070 ft.; drlg.

Burton Drlg. Co.'s No. 1 George Thompson, 150 ft. from N, 150 ft. from E of W 20 acres of 70-ac. tract, 1,600 ft. from E, 2,200 ft. from N, Robert E. Winn Sur. ..... Shut down for drill pipe; T. D. 2,160 ft.

Cordova Union Oil & Land Co.'s No. 1 C. O. Christian, 150 ft. from N, 171 ft. from W of Christiana 36-ac. tract, Robert E. Winn Sur. ..... Waiting on cement to set; T. D. 3,673 ft.

Cordova Union Oil Co.'s No. 2 C. O. Christian, 150 ft. from E and 150 ft. from S of lease and tract, Robert E. Winn Sur. ..... Rig.

Cox and Hamon's No. 1 D. M. Peterson, 150 ft. from SE and NE lines of 41-ac. lease, 2,700 ft. from E and 3,350 ft. from N of Sur., Isaac Ruddle Sur. .... Building derrick.

Curtis and Loe's No. 1 J. S. Bean, 1,650 ft. from S, 200 ft. E of NW cor. of 314-ac. tract and lease, 4,925 ft. from S, 1,075 ft. from W, J. Lewis Sur. .... Set 148 ft. of 10-in.

Elsy Drlg. Co.'s No. 1 J. M. Brightwell, 150 ft. from N, 150 ft. from E of 30-ac. tract, 1,150 ft. from E, 150 ft. from N, Robert W. Smith Sur. ..... Spudded.

Elsy Drlg. Co.'s No. 1 George Thompson, 150 ft. from N, 150 ft. from E of tract of 70 acres and 10-ac. lease, 400 ft. S, 500 ft. W, Henry Dobson Sur. ..... Derrick.

Federated Oil Co.'s No. 1 Laird, 150 ft. from S, 1,221 ft. from W of Laird 55-ac. tract, Isaac Ruddle Sur... T. D. 3,629 ft.

Humble Oil & Ref. Co.'s No. 4 Lou Della Crim, 2,746 ft. W, 150 ft. from N of SE cor., E. G. Sevier Sur..... Drlg. 101 ft.

Humble Oil & Ref. Co.'s No. 5 Della Crim, 3,120 ft. W, 150 ft. N of SE cor., E. G. Sevier Sur. ..... Rig.

Humble Oil & Ref. Co.'s No. 8 L. D. Crim, 4,468 ft. from E and 150 ft. from S of survey, E. G. Sevier Sur.... Derrick.

Humble Oil & Ref. Co.'s No. 9 L. D. Crim, 2,128 ft. from E and 150 ft. from S of survey, E. G. Sevier Sur. ..... Rig.

Humble Oil & Ref. Co.'s No. 1 Ben Laird, 150 ft. from N, 1,219 ft. from W of Laird 100-ac. tract, Isaac Ruddle Sur. ..... Drlg. 2,245 ft.

Humble Oil & Ref. Co.'s No. 2 L. D. Crim, 1,826 ft. from N, 150 ft. from S of Sevier Sur. ..... Flowed 444 bbls. first hour.

Humble Oil & Ref. Co.'s No. 3 L. D. Crim, 2,438 ft. from E, 194 ft. S of Sevier Sur. ..... Drlg. 3,592 ft.

Humble Oil & Ref. Co.'s No. 1-A J. N. Peterson, 254 ft. from SE and direct offset to Federated, 2,250 ft. from W, 2,300 ft. from S, Isaac Ruddle Sur. ..... Drlg. 3,965 ft.

E. M. Jones et al's No. 1 W. R. Crim, 150 ft. from N, 150 ft. from W of 50-ac. tract, Robert E. Winn Sur... T. D. 3,695 ft.; flowed 4,475 bbls. in 24 hours.

E. M. Jones et al's No. 1-A D. M. Peterson, 150 ft. from SW and SE lines of 206-ac. tract and 10-ac. lease, 3,600 ft. from W, 3,800 ft. from S, Isaac Ruddle Sur... Drlg. 2,630 ft.

E. M. Jones and Houston Oil Co.'s No. 1 W. R. Crim, 150 ft. from N and 150 ft. from E of 10-ac. lease, Robert E. Winn Sur. ..... Building derrick.

Karona Oil Co.'s No. 1 J. N. Peterson, 150 ft. from N, 150 ft. from W of tract and 25-ac. lease, 1,200 ft. from W, 1,400 ft. from N, Robert E. Winn Sur. .... Waiting on csg. 3,598 ft.

La-Tex Gas Co.'s No. 1 Major Kennedy, 333 ft. from W of survey and 166 ft. from S line of Kennedy 100-ac. tract, Daniel Clark Sur. ..... Drlg. 2,415 ft.

Lloyd Oil Corp. et al's No. 1 Nicey, 150 ft. from S, 300 ft. from W of 25-ac. tract, Thomas Obar Sur. ..... Drlg. 3,156 ft.

Luling Oil & Gas Co.'s No. 1 Brightwell, 150 ft. from N, 150 ft. from W, Robert Winn Sur. ..... Coring 3,613 ft.

Magnolia Pet. Co.'s No. 1 W. R. Crim, 150 ft. from N, 187 ft. from E of 50-ac. tract, 2,600 ft. from E, 150 ft. from N, Robert E. Winn Sur. ..... Drlg. 3,616 ft.

H. V. Oliver and Brown Drlg. Co.'s No. 1 E. F. Hindman, 150 ft. from N, 150 ft. from E of 5-ac. tract, 850 ft. from E, 3,150 ft. from N, Robert Smith Sur... Building derrick.

Henry Smith et al's No. 1 D. M. Peterson, 150 ft. from SE and SW lines of 110-ac. lease, 2,350 ft. from E, 4,350 ft. from S, Isaac Ruddle Sur. ..... Flowed 170 bbls. per hour through three-quarter-in. choke.

JOINER POOL—RUSK COUNTY

Alford et al's No. 1 W. L. Thrash, 1,103 ft. from N, 420 ft. from E of SE cor., B. Smith Sur. ..... Derrick.

Andrade et al's No. 1 Thrash, 520 ft. from E, 2,100 ft. from S of 78-ac. tract (J. Goodwin on map), M. J. Prue Sur. ..... Derrick.

Andrade et al's No. 2 Thrash, 520 ft. from E, 1,855 ft. from S of 78-ac. tract, M. J. Prue Sur. ..... Building derrick.

Andrade et al's No. 3 Thrash, 845 ft. from E, 1,775 ft. from S of 78-ac. tract, M. J. Prue Sur. ..... Derrick pattern.

Anderson's No. 2 Frederick, 50 ft. from S, 150 ft. from W of Frederick 25-ac. tract, Juan Ximenes Sur. .... Drlg. 3,175 ft.

Anderson's No. 1 Thompson, 150 ft. from N, 150 ft. from E, M. J. Prue Sur. ..... Fishing 3,075 ft.

G. S. Anderson's No. 1 Jobe, 150 ft. out of NW cor. of W 25 acres, Jobe tract, Juan Ximenes Sur. .... Rig up.

G. S. Anderson's No. 2 Jobe, 150 ft. from N and 150 ft. from E of W 25-ac. tract, Juan Ximenes Sur. .... Building derrick.

Babcock Bros.' No. 1 Camp, 150 ft. from N, 171 ft. from E of 4-ac. tract, Juan Ximenes Sur. ..... Drlg. 2,805 ft.

Bahan's No. 1 W. M. Camp, 150 ft. from N, 150 ft. from W of 35-ac. tract, Juan Ximenes Sur. ..... Building derrick.

Capp and Smith's No. 1 J. L. Cochrane, 150 ft. from E, 150 ft. from SE cor. of Cochrane tract, Jacob Roth Sur. ..... Coring 3,505 ft.

Roy I. Carter's No. 1 Mayfield-Alford, 150 ft. N, 200 ft. W of most northern NW cor. of 105-ac. tract, Juan Ximenes Sur. ..... Waiting on csg. 3,587 ft.

Consolidated Oil Co.'s No. 1 Wm. Jobe, 150 ft. from N, 450 ft. from W of lease, S offset to Anderson's No. 1 Fredericks, Juan Ximenes Sur. ..... Drlg. 2,592 ft.

Consolidated Oil Co.'s No. 2 W. M. Camp, 150 ft. from N, 880 ft. from W of Camp 30-ac. tract, S offset to Foster's No. 1 Camp, Juan Ximenes Sur. ..... Waiting on csg. 156 ft.

E. L. Chapman's No. 1 A. P. Finney, 150 ft. from W of E 20 acres of 102-ac. tract, Isaac G. Parker Sur..... Derrick.

Cranfill & Reynolds' No. 1 Calvin Young, 275 ft. from E, 1,780 ft. from S of Young 300-ac. tract, M. J. Prue Sur. ..... Drlg. 1,287 ft.

Dave & Bill Oil Co.'s No. 1 Calvin Young, 150 ft. from E, 1,485 ft. from S of Young tract, N of Lide's No. 1 Young, M. J. Prue Sur. ..... Drlg. 1,222 ft.

George Demonstrend's No. 1 J. A. Bridwell, 150 ft. N, 150 ft. E of Bridwell E 73-ac. tract, M. J. Prue Sur... Fishing for drill pipe 1,306 ft.

Dan Dillion et al's No. 1 W. H. Frederick (Jake), 150 ft. from E, 150 ft. from S of 50-ac. tract, Juan Ximenes Sur. ..... Derrick.

East Texas Oil Co.'s No. 1 C. D. Ashby, 856 ft. N, 1,774 ft. from W of Ashby 119-ac. tract, Juan Ximenes Sur. ..... Shut down 1,650 ft.

East Texas Ref. Co.'s No. 1 C. C. Giles, 502 ft. from E, 300 ft. from S of 79-ac. tract in M. J. Prue Sur. .... Rig up.

Elsy Drlg. Co.'s No. 1 W. M. Camp., 150 ft. from N, 171 ft. from E of Camp. 38-ac. tract, Juan Ximenes Sur. ..... Shut down 1,557 ft.

Federated Oil Co.'s No. 2 Mayfield-Alford, 200 ft. from E, 200 ft. from S of lease on 105-ac. farm, 5,650 ft. from N and 2,600 ft. from W, Juan Ximenes Sur.. Drlg. 1,708 ft.

Federated Oil Co.'s No. 1 Camp, 150 ft. from S and 150 ft. from W of Camp 61-ac. farm, Juan Ximenes Sur. ..... Waiting on csg.

Federated Oil Co.'s No. 2 Camp, 150 ft. from E and 150 ft. from S of 15-ac. lease, Juan Ximenes Sur. .. Spudding.

Foster and Deep Rock Oil Corp.'s No. 2 Ashby, 150 ft. W, 45 ft. S of Alken & Rayzor's No. 1 Ashby, Juan Ximenes Sur. ..... Drlg. 2,910 ft.

Foster and Deep Rock Oil Co.'s No. 2 Camp, 150 ft. from N and 150 ft. from E of lease, 300 ft. NE of No. 1, Juan Ximenes Sur. ..... Rig.

Frank Foster and Little's No. 1 Mayfield-Alford, 150 ft. from N and 150 ft. from W of 45-ac. lease, Juan Ximenes Sur. ..... Derrick.

Frank Foster and Little's No. 2 Mayfield-Alford, 150 ft. from N and 150 ft. from E of 4.5-ac. lease, Juan Ximenes Sur. ..... Derrick.

Foster and Deep Rock Oil Corp.'s No. 3 Ashby, 150 ft. from S, 200 ft. from W of lease, Juan Ximenes Sur.. Derrick.

Foster and Deep Rock Oil Corp.'s No. 2 Camp, 150 ft. from N, 150 ft. from E of 7.5-ac. tract, Juan Ximenes Sur. ..... Set 158 ft. 10-in.; waiting on csg

Foster & Kolp's No. 2 Mayfield-Alford, 150 ft. from E, 150 ft. from S of lease, about 1,300 ft. from W line and 150 ft. from S line of Mayfield-Alford 105-ac. tract, Juan Ximenes Sur. ..... Drlg. 2,905 ft.

Haynes Drlg. Co.'s No. 2 Brown (Minor on map), 150 ft. from E, 150 ft. from S of Brown 76-ac. tract, M. J. Prue Sur. ..... T. D. 3,649 ft.; waiting on csg.

Haynes Drlg. Co.'s No. 3 Brown, 150 ft. from S, 150 ft. from W of lease, M. J. Prue Sur., Juan Ximenes Sur. ..... Drlg. 2,454 ft.

Haynes Drlg. Co.'s No. 4 Brown, 150 ft. from N, 150 ft. from W, M. J. Prue Sur. ..... Rig.

Hefflin et al's No. 1 Thrash, 150 ft. from S, 150 ft. from W of 78-ac. tract, M. J. Prue Sur. ..... Drlg. 1,500 ft.

Hunt's No. 2 Bradford, 1,320 ft. from E, 150 ft. from S of Blk. No. 12, Juan Ximenes Sur. ..... Will standardize and drill deeper; T. D. 3,585 ft.

Hunt's No. 3 Ashby, 221 ft. from N, 2,530 ft. from W of 125-ac. tract, Juan Ximenes Sur. ..... Drlg. 3,580 ft.

Hunt's No. 4 Ashby, 221 ft. from N, 150 ft. from W of most northern NW cor. of Ashby 125-ac. tract, Juan Ximenes Sur. ..... Waiting on csg.; T. D. 3,624 ft.

H. L. Hunt's No. 5 Ashby, 5,500 ft. from W and 3,900 ft. from S of survey, Juan Ximenes Sur. ..... Derrick.

Jones Drlg. Co.'s No. 1 Thrash, 660 ft. from N, 154 ft. from S of SE cor. of J. T. Brown 76.93-ac. tract, 600 ft. from S and 2,200 ft. from E of Sur., M. J. Prue Sur. ..... Rig up.

E. C. Laster's No. 1 Daisy Bradford, 150 ft. from E, 150 ft. from S of Lot 14, Juan Ximenes Sur. ..... Waiting on csg.

E. C. Laster et al's No. 1 B. B. Gray, 1,650 ft. N. 2,425 ft. from E of B. B. Gray 228.25-ac. tract, McLain Sur. ..... Waiting on csg. 3,487 ft.

Lide-Rowe Oil Co.'s No. 1 Calvin Young, 150 ft. from E, 2,690 ft. from S of Young 393-ac. farm, M. J. Prue Sur. ..... Rig up.

John Mabee's No. 1 A. Thrash, 1,550 ft. from W and 3,150 ft. from the N line of survey, Juan Ximenes Sur. ..... Rig up.

Mid-Kansas Oil & Gas Co.'s No. 1 Moore, 150 ft. from N, 162 ft. from E of Moore 200-ac. tract, M. J. Prue Sur. ..... Set 225 ft. 10-in.; waiting on csg.

Mass et al's No. 1 Matthews, 3,244 ft. from N, 4,356 ft. from E. Dalines Cartimas Sur. ..... Drlg. 2,700 ft.

Moss & Urschel's No. 1 Mayfield-Alford, 221 ft. from S, 200 ft. from W of 10-ac. lease, Juan Ximenes Sur. ..... Swabbing at rate of 350 bbls. per day; T. D. 3,630 ft.

Moss and Urschell's No. 2 Mayfield-Alford, 211 ft. from S and 790 ft. from W of lease, Juan Ximenes Sur. ..... Moving in material.

Merrick Oil Co.'s (Gibson & Johnson) No. 1 Ashby, 125 ft. from E, 125 ft. from S of Ashby 45-ac. tract, Juan Ximenes Sur. ..... Drlg. 1,661 ft.

Nat Saddler's No. 1 Ed Sparks, 350 ft. from E, 150 ft. from S of Sur., L. C. Riggs Sur. ..... Shut down 650 ft.

Olsen Bros.' No. 1 Brown, 300 ft. from N, 300 ft. from W of Olsen Bros.' No. 1 Brown, M. J. Prue Sur. ..... Top sand 3,694-97 ft.; waiting on csg.

Olsen Bros.' No. 2 Brown, 150 ft. from S, 150 ft. from E of 76.93-ac. tract, 4,900 ft. from N and 1,750 ft. from E of lease, M. J. Prue Sur. ..... Shut down 217 ft.

Pearl Oil Co.'s No. 1 D. W. Eaton, 975 ft. from most southerly S line of middle tract and 400 ft. from W line of Francisco Cordova Sur. ..... Shut down 200 ft.

Petroleum Marketing Co.'s No. 1 Arnold, 350 ft. from E and 2,100 ft. from S of survey, M. J. Prue Sur. ... Derrick.

Petroleum Marketing Co.'s No. 1 Deason, 1,200 ft. from S line and 1,800 ft. from E line of survey, M. J. Prue Sur. ..... Drlg. 2,600 ft.

Pioneer Oil Co.'s No. 1 Thrash, 1,400 ft. from E line and 4,400 ft. from S line of survey, M. J. Prue Sur. ..... Rig.

Robertson Drlg. Co.'s No. 1 Deason, 3,400 ft. from S and 1,800 ft. from W of survey, Juan Ximenes Sur. ..... Location.

Rusk County Oil Co.'s No. 1 Robertson, 150 ft. from N along W line of George Guthrie Sur. from SE cor., 150 ft. W of E line of Robertson 20-ac. tract, R. H. Pinney Sur. ..... Fishing 1,285 ft.

J. Rusk et al's No. 1 W. B. Thompson, 150 ft. out of SW cor. of 59-ac. Thompson tract, John Dougherty Sur. ..... Derrick.

Rusco Oil Co.'s No. 1 Daisy Bradford, 150 ft. from E, 330 ft. from W, Lot 13, Juan Ximenes Sur. ..... Rig.

Shaw Oil Co.'s No. 1 Robertson, 1,750 ft. from W and 3,050 ft. from S of survey, Juan Ximenes Sur. ..... Derrick.

Shaw Oil Co.'s No. 1 Thrash, 3,200 ft. from the E line and 6,000 ft. from the S line of survey, M. J. Prue Sur. ..... Set 184 ft. 10-in.; waiting on csg.

Shaw Oil Co.'s No. 2 Ashby, 300 ft. from S, 335 ft. from W of 45-ac. tract, and 15-ac. strip lease, Juan Ximenes Sur. ..... Drlg. 3,015 ft.

Sinclair Oil & Gas Co.'s No. 1 Daisy Bradford, 150 ft. from N and 150 ft. from E of Daisy Bradford 35-ac. lease, Juan Ximenes Sur. ..... Building derrick.

Sinclair Oil & Gas Co.'s No. 1 Holland, 150 ft. from S, 197 ft. W of 50-ac. tract, Juan Ximenes Sur. ..... Cored oil sand 3,627-49 ft.; run tubing.

Sinclair Oil & Gas Co.'s No. 2 Holland, 150 ft. from E, 580 ft. from S of lease and Holland 105 ac., Juan Ximenes Sur. ..... Waiting on csg.; T. D. 3,623 ft.

Sinclair Oil & Gas Co.'s No. 3 Holland, 200 ft. from E, 200 ft. from S of 50-ac. lease and 105-ac. tract, Juan Ximenes Sur. ..... Oil sand 3,609-13 ft.; waiting on csg.; T. D. 3,603 ft.

Sinclair Oil & Gas Co.'s No. 4 Holland, 558 ft. from E, 197 ft. from S of 50-ac. lease and 105-ac. tract, Juan Ximenes Sur. ..... Drlg. 1,514 ft.

Sinclair Oil & Gas Co.'s No. 5 Holland, 200 ft. from N and 200 ft. from W of 50-ac. lease, Juan Ximenes Sur. ..... Derrick.

Sinclair Oil & Gas Co.'s No. 6 Holland, 450 ft. from N and 200 ft. from E of 50-ac. lease, Juan Ximenes Sur. ..... Derrick.

E. R. Tennant's No. 1 Daisy Bradford, 150 ft. E and 400 ft. S of NE cor. of Ashby 38-ac. tract, Juan Ximenes Sur. ..... Initial prod. 62 bbls. per hour; T. D. 3,629 ft.

E. R. Tennant's No. 2 Brooks, 1,300 ft. from E and 6,500 ft. from S of survey, M. J. Prue Sur. ..... Derrick.

Tennant, receiver's No. 1 Harvey Brooks, 1,200 ft. from N, 150 ft. from W of Brooks 176-ac. tract, M. J. Prue Sur. ..... Drlg. 2,819 ft.

Tidal Oil Co.'s No. 1 W. W. Holland, 150 ft. from S, 1,252 ft. from W of Holland 105-ac. tract, Juan Ximenes Sur. ..... Fishing for core head 3,657 ft.; cored oil sand 3,632-41 ft.

Turman Oil Co.'s No. 1 Deason, 770 ft. from N, 150 ft. from W of 50-ac. tract, M. J. Prue Sur. ..... Spudding.

United Prod. Oil Co.'s No. 1 Mayfield-Alford, 150 ft. from S, 2,233 ft. from 105-ac. tract, Juan Ximenes Sur. ..... T. D. 3,607 ft.; set csg.; sand 3,595-3,606 ft.

Warner-Quinlan's No. 1 Camp, 197 ft. from N, 271 ft. from W of Mrs. C. Long 3-ac. lease, Juan Ximenes Sur. ..... Coring 3,598 ft.

West Texas Oil & Ref. Co.'s No. 1 John Tolly, 150 ft. from N and 150 ft. from E of 11-ac. tract, Juan Ximenes Sur. ..... Rig up.

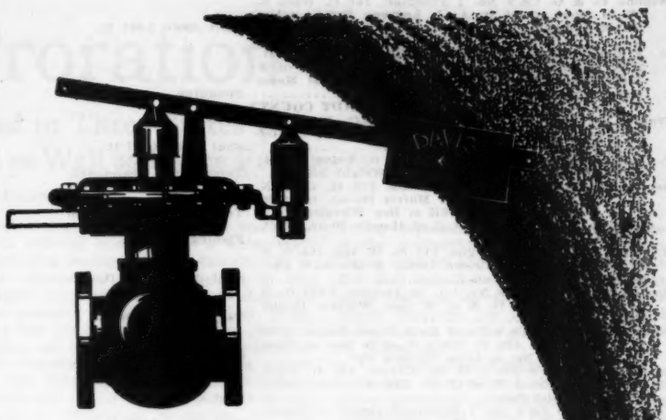
Witherspoon et al's No. 1 Daisy Bradford, 200 ft. from S of N line, 1,500 ft. E of W line of Bradford 23-ac. lease, Juan Ximenes Sur. ..... Rig up.

SMITH COUNTY

Big Indian Oil Co.'s No. 1 Mills, 1,045 ft. E along S line of C. Mills 67.8-ac. farm, SW cor. of same and 710 ft. N at right angles to S line of 67.7 acres, J. Jordan Sur. ..... Derrick.

Guy V. Lewis' No. 1 S. S. Cooke, 150 ft. from E and 150 ft. from S of Cooke 58.5-ac. tract, J. Jordan Sur. ..... Drlg. 2,076 ft.

Thayer & Rogers' No. 1 Willingham, 150 ft. N and W of 14.5-ac. tract, Jacob Hernin Sur. ..... Shut down 2,400 ft.



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Winona O. & G. Co.'s No. 1 Freeman, 150 ft. from S, W of 89-ac. tract in A. J. Legrone Sur., 4 miles SE of Winona ..... Shut down 3,681 ft.

UPSHUR COUNTY

D. Armand et al's No. 1 Marshall Fluellan, 450 ft. from N and 450 ft. from E of W 50 acres of S 100 acres of Fluellan 417-ac. farm, Marshall Mann Sur. ..... Spudding.

VAN ZANDT COUNTY

Cranfill & Germany's No. 1 Swain, 137 ft. N and 50 ft. from W of excess strip on W side of O. L. and L. L. Swain farm ..... Shut down 1,167 ft.

T. Daniels' No. 1 Fannie Cumbine, 185 ft. S and 175 ft. E of NW cor. 156-ac. tract, John Wright Sur. ..... Temporarily abandoned.

Dennis Oil Co.'s No. 1 C. W. Morris, 100 ft. from N and 300 ft. from E line of Morris 160-ac. tract in C. L. Morris Sur., 5 miles SE of Ben Wheeler ..... Temporarily abandoned.

J. C. Fare's No. 1 P. S. Hand, C of Hand's 50-ac. tract, William Shuman Sur. ..... Fishing 5,160 ft.

H. Helms et al's No. 1 Bogue, 647 ft. W and 155 ft. S of SE cor. of J. M. Brown 70-ac. in Marshall University Sur., SE of Van ..... Shut down 3,098 ft.

Humble Oil & Ref. Co.'s No. 1 L. A. Dowdle, 1,027 ft. N of S line and 150 ft. E of W line, William Daniel Sur. ..... Temp. abnd. 2,987 ft.

Humble Oil & Ref. Co.'s No. 9 Ruth Starr Blake, 2,340 ft. from E and 620 ft. from N of N line of Pure Oil Co.'s tract No. 2, John Walling Sur. ..... Cementing csg.

Imperator Oil Co.'s No. 2 G. W. Carter, 175 ft. from S and 35 ft. from W of G. W. Carter 171-ac. tract, William Daniel Sur. ..... Shut down.

Kelly Oil & Gas Co.'s No. 1 Lemsford, center of Lemsford tract, John Conner Sur. ..... Shut down 2,300 ft.

Nell McMehory's No. 1 R. V. Murphy, 150 ft. from N and 150 ft. W of survey, H. Bailey Sur. ..... Shut down 263 ft.

Pure Oil Co.'s No. 2 A. G. Tunnell, 250 ft. N of S line and 200 ft. W of E line, John Walling Sur. ..... T. D. 2,942 ft.; testing; shut in.

Pure Oil Co.'s No. 1 Davis, 127 ft. from S and 200 ft. from W of 139-ac. tract, Nacogdoches County School Land ..... Derrick standing.

Pure Oil Co.'s No. 4 W. F. Swain, 250 ft. S of N line and 200 ft. W of E line of lease, Mund Gross Sur.... Derrick.

Pure Oil Co.'s No. 2 J. D. Miller, 250 ft. N of S line and 250 ft. E of W line of lease in John Walling Sur. ..... Running liner 2,933 ft.

Pure Oil Co.'s No. 6 W. T. Jarman, 344 ft. W of E line and 250 ft. S of N line of 8-ac. tract, Nacogdoches County School Lands ..... Cement setting 2,792 ft.

Pure Oil Co.'s No. 9 A. D. Clark, 200 ft. W of E line and 495 ft. S of N line of lease, John Walling Sur. ..... Oil sand 2,680 ft.

Pure Oil Co.'s No. 2 R. E. Cade, 225 ft. E of W line and 893 ft. N of S line of lease, A. McPhail Sur. .... Cement setting 2,774 ft.

Pure Oil Co.'s No. 12 R. L. Wells, 250 ft. S of N line and 744 ft. E of W line of lease, H. V. Moore Sur. ..... Drlg. 2,468 ft.

Pure Oil Co.'s No. 4 O. L. Swain, 250 ft. W of E line and 647 ft. N of S line of lease, John Walling Sur. ..... Cement setting 2,312 ft.

Shell Pet. Corp.'s No. 9 R. L. Fowler, 203 ft. N of S line and 150 ft. W of E line of lease, John Walling Sur. ..... Cement setting 2,557 ft.

Pure Oil Co.'s No. 1 R. A. Enas, 635 ft. E of W line and 150 ft. S of N line of lease, Jackson Thomas Sur. ..... Drlg. 2,878 ft.

Pure Oil Co.'s No. 4 F. B. Smith, 400 ft. E of well No. 3 and 250 ft. E of W line of lease, John Walling Sur. ..... Cement setting 2,685 ft.

Pure Oil Co.'s No. 3 Ella York, 250 ft. S of N line and 250 ft. E of W line, John Walling Sur. ..... Drlg. 2,350 ft.

Pure Oil Co.'s No. 1 Frank Blackstock, 88 ft. N of S line and 200 ft. E of W line of lease, John Walling Sur. ..... Drlg. 2,515 ft.

Roy Stampff's No. 1 Riggs, 169 ft. from E and 155 ft. from S of 3-ac. tract, William Daniel Sur. ..... Derrick (rotary).

Sun Oil Co.'s No. 2 T. J. Wallace, 250 ft. S of N line and 250 ft. W of E line of lease, John Walling Sur.... Drlg. 224 ft.

Van Oil Association's No. 1 Tankersley, 200 ft. from E and 1,000 ft. from S of farm, L. Landers Sur. ..... Shut down 1,026 ft.

Vitek Oil Co.'s No. 1 Smith, 150 ft. S and 15 ft. from W of L. A. Smith 40-ac. farm in John Walling Sur.... Derrick.

Wilson et al's No. 1 Stribling, 1,563 ft. W of E line and 800 ft. S of N line of M. B. Fisher 172-ac. in Phillips Mason Sur. ..... Shut down 1,590 ft.

WOOD COUNTY

Loche & Clark's No. 1 A. C. Pick, 165 ft. S of NE cor. G. C. Reeves 25-ac. tract, Daniel Fuller Sur. .... Shut down 997 ft.

INCREASE IN DEMAND IS PRINCIPAL HOPE

(Continued from Page 36)

This business has been absent for more than a month, leaving the North Texas and the North Louisiana and Arkansas refiners to sell added quantities of their products in the normal marketing territory supplied by the Oklahoma plants. Rumanian gasoline is apparently replacing American gasoline in some of the foreign markets which is accounted for by the fact that Rumanian gasoline is being offered to the French market equivalent to 4.3 cents at the Gulf on 375 endpoint material.

Kerosene

A wider range of prices existed also, reflecting the offering of material of a correspondingly wider range of quality. In order to shade the price, substantial quantities of sweet kerosene have been offered but which had not been given the usual treatment. In other instances, kerosene with poor color stability, has been offered at a slight price reduction. The effect has been to weaken the general market although most refiners say they are moving a normal quantity of their production at last week's quotation.

Natural Gasoline

All grades of natural gasoline were reduced in price during the week, reflecting the lack of buying on the part of refiners and there has been nothing to encourage the belief that export buyers would strengthen the situation. February has generally been a month in which the prices have been held to a low level and some encouragement is felt in the belief that increased consumption will soon begin to be felt.

Fuel Oil

There were no changes in the list of fuel oil quotations although several times during the past week, substantial quantities of distress fuel appeared on which was quoted a price of 2½ to 5 cents under the market. There is a noticeable trend toward demanding more stringent specifications on the part of the buyer and in addition to gravity, cold test and b.s., he is now demanding a certain viscosity and flash. He expects to pay only the general published prices and those refiners who do not find themselves able to meet these special requirements have had to resort to price concessions from time to time.

Except for the belief that jobbers will now gradually increase their purchases of motor oils to take care of the coming seasonal increase in the demand there was little encouragement seen in business as a result of lower bright stock prices posted a week ago. There were no further price changes.

Wax has been moving at a normal rate and the curtailed refinery operations has decreased the supply to a point where consumption is taking refiners' output with instructions for shipments coming in, in advance. At present, the domestic consumption of wax is maintaining the market, rather than the foreign needs.

Further Curtailment In California Urged By State Committee

LOS ANGELES, Calif., Feb. 28.—In its report following a survey of the California crude oil curtailment situation, the state-wide curtailment committee, of which J. A. Brown, president of General Petroleum Corp., is chairman, recommends continuance of the curb on production. The report states:

"Our survey of the California producing fields shows that the potential daily capacity of existing wells of the State is in excess of 1,100,000 bbls. daily, that there are excessive stocks of gasoline, fuel oil and refining crude above ground. Important known fields have been held back in their development and the potential producing capacity of the State could therefore be quickly increased by another 500,000 bbls. daily."

Under present curtailment, allowable production of the State is fixed at 500,000 bbls. daily average, although actual output is running about 30,000 bbls. in excess of this amount.

The committee makes several specific recommendations of governing principles for a permanent future program, treating the various phases of the producing and marketing situation. Correction of abuses and regulation of both development and production are given consideration in the report, which recommends that new fields be operated on the unit plan, or, if this is impossible, that they be prorated according to factor which gives equal weight to the proved acreage and the average potential production.

CONTRAST EARNINGS OF OIL INDUSTRY FOR 1930

(Continued from Page 192)

clared the regular quarterly dividend of 40 cents, payable March 31, to stock of record March 16.

Twenty Representative Stocks

The Oil and Gas Journal's weekly average price of 20 representative petroleum stocks listed on the New York Stock Exchange and New York Curb, based on closing quotations for Wednesday, was as follows:

June 25	42.37	Oct. 29	32.80
July 2	44.13	Nov. 5	31.77
July 9	44.11	Nov. 12	30.18
July 16	46.42	Nov. 19	31.54
July 23	46.06	Nov. 26	30.86
July 30	44.89	Dec. 3	30.53
Aug. 6	45.24	Dec. 10	28.57
Aug. 13	43.53	Dec. 17	25.42
Aug. 20	43.79	Dec. 24	25.68
Aug. 27	42.83	Dec. 31	26.15
Sept. 3	42.71	Jan. 7	27.56
Sept. 10	42.84	Jan. 14	27.31
Sept. 17	42.43	Jan. 21	27.55
Sept. 24	40.62	Jan. 28	27.26
Oct. 1	37.75	Feb. 4	27.26
Oct. 8	35.85	Feb. 11	28.76
Oct. 15	35.21	Feb. 18	28.53
Oct. 22	31.88	Feb. 25	29.33

A.P.I. CONTINUES TO FIGHT FOR THE CODE

(Continued from Page 37)

dignified respect for contractual obligations.

"(f) The code is preventing fraud and deception of products.

"(g) The code, by requiring each marketing company to post publicly the price at which it offers its products for sale, informs the purchaser of petroleum products of the price which he should pay and promotes fair and honest competition. It does not sanction price agreements but leaves each company at perfect liberty to fix its own price according to its own discretion.

"We feel that the abandonment of the code by the marketing branch of the petroleum industry would be a distinct calamity and result in great confusion."

The board of directors at their meeting today voted to appoint a committee to determine whether or not the oil business as an industry will furnish exhibits for the World Fair which will be held in Chicago in 1933.

W. T. Holliday, president of the Standard Oil Co. of Ohio, who was recently appointed chairman of a committee to investigate the feasibility of a uniform gasoline tax law for the states, reported that the committee would shortly be in position to offer a model law for the consideration of the board.

Action on the recent request that a supply section of the institute be organized was postponed. It is understood that no action will be taken until a larger number of the supply concerns serving the oil industry have joined in the request for the new division.

The board at the request of the automotive transportation section approved in principle the uniform vehicle code adopted by the national conference on street and highway safety.

PIPE MILLS INTERESTED IN VARIOUS PROJECTS

By B. E. V. Luty

PITTSBURGH, Pa., Mar. 2.—Various pipe line projects are being figured on and there are rumors that some of them will lead to orders being placed with pipe producers very shortly. The only business definitely reported as placed is a release on the remainder of the Missouri-Kansas Pipe Line Co.'s order placed with the National Tube Co. nearly a year ago, calling for 350 miles of 24-inch, 325 miles of 22-inch and a lot of smaller sizes. There remained to be made and laid 83 miles of 22-inch, about 15,000 tons. While the original order was for fire weld, National Tube Co. has since completed its electric weld department and an arrangement has been made whereby the 83 miles will be furnished in electric weld. The order is now going into production and will engage the department for several weeks.

A contemplated gas line will involve 378 miles of 8, 10, 12 and 14-inch, about 30,000 tons, to run from Muskrat, Wyo., to Bridgeport, Neb., by the North Central Gas Co. The Texas-Oklahoma Gas Co. has secured prices on about 10,000 tons of 8⅝ and 12¾-inch pipe for a gas line within the State of Texas. A Rumanian oil line requires 14,000 tons, but as the allocation to the United States would be only 12 per cent and bonds would have to be accepted, the inquiry is not particularly interesting. It has lately been stated that the Pacific Gas & Electric Co., which recently laid a long gas line in California, now plans to lay a 20-inch line from California to Seattle, but the report mentions 20-inch and a total of 60,000 tons, which would not cover the ground. Long pending business includes a Standard Oil of New York 6-inch gasoline line from East Providence, R. I., to Worcester and Springfield, Mass.

U. S. MANUFACTURES 90 PER CENT WORLD'S GASOLINE

(Continued from Page 186)

and the output is not included with crude oil production.

All of the Colombia production and virtually all of that in Venezuela is mixed with crude oil and included in the figures of crude oil production. The Argentine production is shipped by rail or boat to refineries and is not included in the crude oil production figures. In British India some portion of the natural gasoline output is handled separately by pipe line and the remainder is turned into crude oil pipe lines and included with the crude oil production. The Japanese production, as well as that in Taiwan, is handled separately from the crude oil production. The natural gasoline produced in Sarawak is transported by pipe line to the refinery but the production is included in the crude oil production reported. All of the Egyptian production is mixed with crude oil at Hurghada and shipped to the refinery at Suez. The Mexican production is handled apart from the crude oil production. Of the 3,864 bbls. reported for Trinidad, 3,085 bbls. were mixed with crude and 779 bbls. marketed directly as motor fuel.

All Have Voice in Proration Measures

Personnel of Committees Named in Three States Believed to Insure Square Deal for Small as Well as Large Producers

By James McIntyre

Widespread consideration of the question of proration of crude oil production has prompted an examination of the make-up of the proration committees in each of the three states to see if any one interest occupies a dominant position on any or all of them. Of the 22 men who have accepted the difficult and thankless task of keeping production and demand on an even keel, and maintaining reserves in the ground, seven are individual oil producers. The Texas Company is represented by two men. The Pure Oil Co., Skelly Oil Co., Indian Territory Illuminating Oil Co., Continental Oil Co., Prairie Oil & Gas Co., Texas Pacific Coal & Oil Co. and Shell Petroleum Corp. each have one representative. One member is a state official. The Standard Oil Co. of New Jersey has two, Standard Oil Co. of Indiana one and Standard of California two (one man serving on two committees). No one company has more than one representative on any state committee and no one company is represented on all three state committees.

The Oklahoma statewide proration committee for 1930-31 is made up of the following men: Alvin Richards, Pure Oil Co., chairman; Burdette Blue, Indian Territory Illuminating Oil Co.; E. R. Filley, The Texas Company; Wirt Franklin, Wirt Franklin Petroleum Corp.; E. J. Nicklos, Continental Oil Co.; Joseph S. Sidwell, Prairie Oil & Gas Co.; R. M. Young, Carter Oil Co.; H. B. Fell, Simpson-Fell Oil Co. Of the above eight men, officials of eight widely different oil companies, only one has any connection with a Standard Oil Co. Richard M. Young is president of the Carter Oil Co., a producing subsidiary of the Standard Oil Co. (New Jersey). The Texas, Continental and Pure, all represented on the committee, are active marketing competitors of one or another Standard Oil Co. organization in every part of the United States. The Indian Territory Illuminating Oil Co. is a producer, pure and simple, owned in part by the Cities Service Corp. and in part by H. B. Foster, son of its founder. The Wirt Franklin Petroleum Corp. is a producer, refiner and marketer of crude and its products, and the Simpson-Fell Oil Co. is a producer in the south end of the State.

Committee Has Worked Harmoniously

The Standard has a 12½ per cent voice in the proceedings and action of the Oklahoma statewide proration committee. The independents have 87½ per cent of the influence that leads to the findings of this committee. The committee, like the one that preceded it, which was headed by C. C. Herndon, vice president of the Skelly Oil Co., has worked harmoniously and few men in the oil industry have ever questioned its good faith, or pretended to believe that it was influenced by any other motive than the best interest of the general oil industry and the protection of the public in the conservation of crude oil.

The statewide proration committee in Texas is composed of Robert R. Penn, producer; Charles Roeser, of Roeser & Pendleton, producers; George Calvert of Broderick & Calvert, producers; R. H. Morrison of the California Co.; John R. Suman, of the Humble Oil & Refining Co.; A. M. Donoghue, of the Texas Pipe Line Co.; Tom Cranfill, producer, and David Donoghue of the Texas Pacific Coal & Oil Co. Of this group, Penn, Roeser, Calvert and Cranfill are independent producers. The Humble Oil & Refining Co., represented by John R. Suman, is a subsidiary of the Standard Oil Co. (New Jersey). The California Co., represented by Mr. Morrison, is a subsidiary of the Standard Oil Co. of California. The two remaining members, A. M. Donoghue and David Donoghue are connected with companies that compete as producers, refiners and marketers with Standard Oil companies.

Of the committee of eight in charge of the proration movement in Texas two, or 25 per cent, are Standard men. Six, or 75 per cent, have no connection with any of the Standard units outside of a possible lease partnership, here and there, such as is common in every field in the country where companies, firms and individuals hold part ownerships in leases, drilling operations or producing properties with other operators, including whatever Standard company or companies may be operating in the same territory.

Lea County's Prorationists

The proration committee in Lea County, New Mexico, is made up of R. H. Morrison, of the California Co.; Henry W. Walker of the Walker Oil Co.; A. B. Crile, commissioner of public lands of the State of New Mexico; E. G. Allen, of the Shell Petroleum Corp.; J. P. Cusack, of Skelly Oil Co.; and H. C. Bretschneider, of the Midwest Refining Co. Here again we have a predominance of non-Standard members. Two Standard subsidiaries are represented, the California Co. and the Midwest Refining Co., the latter a subsidiary of the Standard Oil Co. of Indiana, and the committee is composed of six men, one of whom is a state official, watching the interests of the State and the people of New Mexico.

In the three states 22 men are in charge of proration plans, five of whom are Standard men and 17 of whom are not.

Operating in the three states are a number of Standard companies with no representation on any of the proration committees and no more voice in the work of the committees than the lowliest owner of old stripper wells. The Standard Oil Co. of New York has no representation even though its subsidiary, the Magnolia Petroleum Co., is one of the biggest producers of oil in the territory, with refining interests and a widespread marketing business. The Ohio Oil Co. is not represented even though it is the largest potential and actual producer in the prorated Yates Pool in West Texas and has large interests in other parts of Texas and in Oklahoma and New Mexico. The Standard Oil Co. of Indiana, owner of the Dixie Oil Co. and the Southern Crude Oil Co. is not represented on the Texas or Oklahoma committee and has but a 16⅔ per cent voice on the New Mexico committee through H. C. Bretschneider of the Midwest Refining Co. The Vacuum Oil Co., with production in the Gulf Coastal fields, and a large buyer of Mid-Continent crudes selected for their high lubricating oil content, is without a representative on any of the proration committees.

The great Gulf Oil Corp. is not represented on any of the three proration committees and the Royal Dutch-Shell organization is represented on neither the Oklahoma nor the Texas committee.

Curtailing Own Production

It is a significant fact that some of the companies with the largest production under curtailment are active workers in the conservation of crude under ground. The Indian Territory Illuminating Oil Co. owns nearly 42 per cent of the producing wells in the Oklahoma City Field. It opened the field. It also opened the Seminole Pool, and the Bowlegs and Little River Pools in the Seminole Field and from the first has been one of the largest, if not the largest, producer in that field. The company is represented on the Oklahoma statewide proration committee by one of its vice presidents, Burdette Blue. Mr. Blue, Wirt Franklin, E. J. Nicklos and J. S. Sidwell, all members, represent over 50 per cent of the wells in the Oklahoma City Pool. Messrs. Richards, Filley and Young represent companies with large shutin production in the Van Pool in Texas and in the Seminole area, while Mr. Fell may be said to represent that large body of so-called small operators whose interests lie in the old settled fields known in the proration schedules as "Class A."

Only Fact Finding Bodies

In the discussion of the work of the three proration committees it must be understood that they are merely fact-finding and advisory bodies. The work of the Oklahoma statewide proration committee is typical of all of them. Nothing it does is necessarily final. It is its duty to go out and find the largest market for crude oil that industrial conditions warrant. The committee makes a careful canvass of every recognized oil buyer to ascertain how much oil it can purchase for say a three-month period. That being learned, together with the source from which the purchaser wishes the oil to come, the committee sets to work on the various pools under proration to allocate the production to the pipe line carriers so that a ratable taking of the potential production of the field may be had.

The committee establishes a set of rules and regulations governing the methods of ascertaining potentials; fixes the percentage of production that may be taken and allocates the runs to the pipe lines. State and field umpires are named and advisory subcommittees on proration in each pool (made up of representatives of operators in that pool) are appointed. When all is done to the satisfaction of the statewide committee it issues calls for meetings of the operators and purchasers in each of the fields or pools that are to be prorated, and the plan is put up to them for judgment. If the operators and purchasers are satisfied with the plan they adopt it. They may amend it and adopt it as amended. When the operators in the affected fields have been satisfied, the plan is submitted to a statewide meeting of oil men and again threshed out, and when this body gets through with it the plan is submitted to the Corporation Commission together with a petition that the commission issue a proration order covering the recommendations.

Utmost Publicity

All along the line the utmost publicity is accorded the proceedings. Any oil man or state or federal official may "sit in" on the proceedings of the statewide committee, and the subsequent meetings are open to objectors. At the hearings before the Corporation Commission the commissioners listen to arguments pro and con on the question of issuing the proration orders.

There is little material difference in the machinery of proration in the three States, Oklahoma, Texas and New Mexico. The Oklahoma Corporation Commission has more authority under the law than the Texas Railroad Commission or the New Mexico Public Land Office, but a recent court decision has strengthened the hands of the Texas Railroad Commission and a bill has been introduced in the state legislature in the further interests of oil and gas conservation. Thus far in New Mexico no compulsory law has been needed, as there has been no serious objection to prorating the tremendous new fields, which can produce several times as much oil as the pipe lines can move.

Oklahoma City Largest Producer

It has been asserted that the Oklahoma City Field has been unfairly treated by the proration committee. As a matter of fact, Oklahoma City ranked first in production among Oklahoma pools in 1930, and only three fields in the United States exceeded it in production, two in Cali-

CONTINENTAL HAS CONVENIENT TRUCK FOR PIPE LINERS

This comfortable truck built by the Continental Pipe Line Co. for small pipe line gangs takes a trailer when large tools are required. If only a few joints of pipe are needed they are placed on the sides and held by movable stakes. A body built almost entirely of steel adds to safety.

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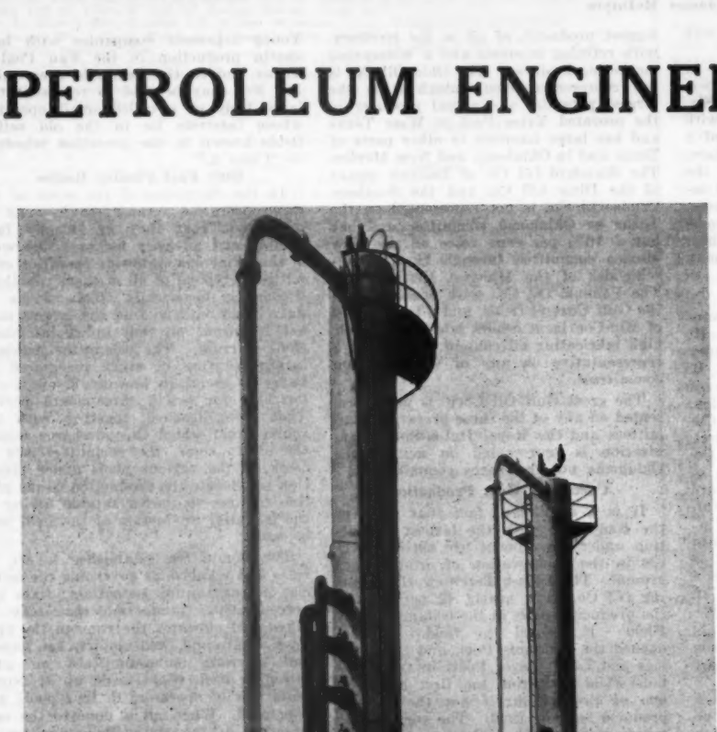

FOR

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Petroleum Engineering, Inc., columns and equipment in an Oklahoma refinery. On the left, 48″ column functioning as Pressure Distillate Stabilizer and Vapor Recovery Unit; on the right, 36″ column functioning as Naphtha Stabilizer.

PETROLEUM ENGINEERING, INC.

PHILTOWER BUILDING TULSA

ATHLETIC CLUB BUILDING DALLAS

REPRESENTED THROUGHOUT THE WORLD BY

THE NATIONAL SUPPLY COMPANIES

fornia and one in Texas. The Santa Fe Springs Pool in California was prorated down to 44,251,396 bbls. in 1930, having produced 76,477,464 bbls. in 1929. Long Beach, California, was kept down to 36,599,688 bbls. in 1930. Pecos County, Texas, was permitted to produce 42,603,498 bbls. last year. The Oklahoma City Pool, which produced 8,709,727 bbls. in 1929 found a market for and produced 34,603,067 bbls. in 1930. It now has permission to produce 125,000 bbls. a day, which is at the rate of 45,625,000 bbls. per year if the producers can find a market on a ratable basis. The Van Pool in Van Zandt County, Texas, was held down to 7,530,222 bbls. last year, while the Hobbs Pool in New Mexico, with its million-barrel potential, is kept down to around 30,000 to 35,000 bbls. per day.

Oklahoma City would have produced much more oil than its 1930 record shows had general industrial conditions warranted it. The statewide proration committee gave Oklahoma City an allowable production that would have aggregated 47,000,000 bbls., or more, last year, but the demand for oil was not sufficient to warrant running that quantity and the pipe lines fell about 11,000,000 bbls. short of taking all the allowable. This allowable of over 130,000 bbls. per day as an average over the year was based on expected demand, which was not fulfilled.

Purchasers Overconfident

In other words, when the crude oil purchasers submitted to the proration committee the quantity of oil they thought they would require in the ensuing three months, they were overconfident of the future of general business conditions. In none of the quarterly periods was the demand for crude as great as the purchasers figured it would be, therefore the allowable production of Oklahoma City fell 11,000,000 bbls. below expectations, and it is doubtful if any of the very large fields in the United States produced as much oil as the operators hoped for at the beginning of 1930. Instead of improving, general business conditions became worse and the expected increase in the demand for oil products did not materialize.

Meanwhile, the oil industry struggled through 1930, running a lap or two ahead of the sheriff throughout the year, by keeping its crude oil reserve where it belongs. If production had been let loose disaster to many oil men and oil companies would have resulted. Picture conditions in the Oklahoma City Field with a 50-cent oil market. Over $200,000,000 will be spent in that field to drill and develop it. With 100,000,000 bbls., the flush production, selling at 50 cents per barrel, or maybe less, how much would the producers have to receive for the balance of the recoverable oil in that field to break even on their investment?

GULF MARKETS INACTIVE AND PRICES ARE SHADED

HOUSTON, Tex., Mar. 2.—Except for gasolines, which reflected a weaker tone following further slipping of North Texas markets, there was very little change in Gulf Coast refinery markets the past week. Despite the fact that most sellers had thought gasoline prices at absolute bottom several weeks ago material was being offered at coastal ports and refineries an eighth to a quarter cent under prevailing quotations a week ago.

Movement of gasoline, both export and for domestic demand, has been unusually inactive with virtually no export business being done, due, it is reported, to Rumanian competition. Also, although the Atlantic Seaboard market is in fair shape, for some reason coastwise demand for gasoline has been slow.

The local domestic market outlet for gasoline is being held fairly firm in price with refiners trying to get from 5½ to 6 cents. However, the demand for material on this basis is not large. Bulk cargo material is being offered freely around 4½ cents.

Pale and red oils are beginning to feel the effect of the long period of inactive demand and concessions from the prevailing posted quotations are being reported. No general change has been made except in the weaker tone reflected by a growing competition for business.

Fuel and gas oils apparently were steady at previous quotations of 65 to 70 cents for cargo fuel; 90 cents, bunker fuel; and 3⅛ to 3¼ cents for gas oil. Although there is no spot demand or other new business for these products sellers are making no special effort to move their material.

Late Fields

(Continued from Page 46)

27-2. It was showing oil in the top of the Simpson sand at 3,245 feet, where the casing was cemented.

Magnolia Petroleum Co.'s No. 4 Wheelock, NW cor. SE SE NE Section 19-27-2, is a new location in the same pool.

Continental Oil Co. announces a new wildcat location for Reno County. The test is No. 1 in the SW cor. SE Section 23-23-4w, and is located about 3 miles southwest from the new well recently completed by Study and others in Section 1-23-4w.

Stearns & Streeter's No. 1 Tobin, SW cor. SE NE Section 5-27-2, a wildcat north of the Eastborough Pool, was drilling in the Wilcox sand at 3,348-52 feet with nothing showing. The Viola had a hole full of water from 3,315-17 feet.

Miller and Shell Petroleum Corp.'s No. 1, NW cor. Section 32-19-1w, a half mile southeast of the deep sand production in the Canton area, McPherson County, found 5,000,000 feet of gas in the chat at 2,940-47 feet and oil and water from 2,990-3,045 feet, where it was flowing 1 bbl. of fluid an hour, still in the chat.

Olsen and Shell Petroleum Corp.'s No. 1 in the C SE SE Section 3-19-2w, north of the Decker gas area, was drilling in chat at 2,927-30 feet, with nothing showing.

J. H. Rush and Shell Petroleum Corp.'s No. 1, C SE cor. NW Section 10-19-2w, in the Decker gas field, found a showing of gas in the chat at 2,921 feet, and was drilling deeper.

OKLAHOMA

Production from the Oklahoma City Field was extended Monday by the completion of another well on the west side of the pool. Oklahoma City Petroleum Co.'s No. 1 Lively, NE cor. NW SE, Section 15-11-3w, flowed 68 bbls. of oil in 15 minutes and was estimated to be flowing at the rate of 250 bbls. an hour, when tested. The operators believe the hole is bridged as there was little gas. The well will be cleaned out and tested again. The total depth is 6,493 feet in the Wilcox sand. Production was extended a quarter of a mile west by the well.

H. H. Patton and others' No. 1 Short, NW cor. SW, Section 10-11-3w, flowed 2,275 bbls. the first four hours from the Wilcox sand at a total depth of 6,410 feet. The gas was estimated at 18,000,000 feet a day. Mid-Texas Petroleum Co.'s No. 1 Aungst, NE cor. NW, Section 3-11-3w, in the north end of the pool, flowed 2,097 bbls. of oil the first hour, and the well was shut in. The gas was estimated at 50,000,000 feet a day. The total depth of the well is 6,324 feet in sand. Phillips Petroleum Co.'s No. 1 Davis, NW cor. NE NE, Section 10-11-3w, was bailed down Saturday and shut in at once because of the lack of storage on the lease. It is estimated to be a 20,000-bbl. well from a total depth of 6,445 feet.

Truax Oil Co.'s No. 1 fee, NE cor. NW, Section 12-15-6, northeast of Chandler in Lincoln County, made 25,000,000 feet of gas from the Wilcox sand at 3,647-95 feet. The well was shut in to erect separators and tankage as it was also making what was estimated to be 40 bbls. a day of oil.

Prairie Oil & Gas Co. and others' No. 1 Upperman, SW cor. NW, Section 22-22-1, Noble County, had the top of the Simpson sand at 4,656 feet and was drilling at 4,662 feet, showing 5 bailers of water.

Clark & Cowden's No. 2 Brown, SE cor. NE, Section 12-4-7, east of Ada, in Pontotoc County, found a showing of oil and gas at 1,928-30 feet. Operators will make a production test.

CONGRESSIONAL ACTION

WASHINGTON, D. C., Mar. 3.—The Senate today approved a house ways and means investigation during the recess of the economic conditions in the oil, coal, lumber, manganese and agricultural industries, all of which had sought a tariff or embargo relief.

The House ordered the Tariff Commission to make a thorough inquiry into petroleum costs and report to the next Congress.

The Garber house resolution directing the Tariff Commission to investigate relative costs of oil production in the United States and foreign countries was adopted.

GOVERNORS MEET ON CRUDE OIL SITUATION

(Continued from Page 39)

under which the corporation commission is now regulating production, and which the Jones bill seeks to restrict as to its provisions.

Mr. Franklin gave a history of the fight of 16 years ago to have the bill passed and he tore into the men who are now seeking to weaken the conservation law and to break down or weaken the proration plan. He charged that H. F. Sinclair had sought to have him join in the fight against proration by offering to take 25,000 bbls. a day of Franklin's Oklahoma City oil if proration was ended, an offer, he said, he turned down at once. He denied that he represented "Standard Oil." He claimed that "Standard Oil" and "other large companies" had tried to shut off his credit while he was fighting for a tariff on foreign oil.

Mr. Franklin condemned the conduct of "fly by night promoters" operating in the Oklahoma City Field and said that if this class of operators had been producing oil previous to the passage of the 1915 conservation act under the "law of the jungle" they would be thankful for proration.

The Distress Well Situation

Operators in the distress oil areas in northern Oklahoma held a meeting in Tulsa on March 2, and appointed a committee to carry on the work of seeking a market for the oil. The new committee is made up of Winston P. Henry, chairman; Bruce Martin, J. B. Steele, K. C. Holm, G. I. Van Dall and D. L. Owsley, secretary, all of Tulsa; and W. B. Way, Pawhuska, and T. R. McSpadden, Nowata. No definite action will be possible until the committee secures an accurate list of the distressed oil properties, the legal description, name of the operator, number of wells, daily average production, approximate amount of storage on the lease and if the offset is being operated, and other information.

A former committee consisting of E. B. Lawson, chairman, Tulsa; H. G. Ellis, Bartlesville; J. B. Milam, Chelsea; and J. Wood Glass, Nowata, which handled the contract for the Coody's Bluff-Alluwee-Childers area, and the Tulsa-Osage committee with E. C. Lawson, chairman; Bruce Martin, Tulsa; J. B. Steele, Tulsa; Vern Vensel, Tulsa; and Winston P. Henry, Tulsa, which completed the arrangements in the Tulsa-Bird Creek-Skiatook area, reported at the meeting and resigned.

A resolution was passed asking the Corporation Commission not to grant an increase in the allowable flow of the Oklahoma flush fields until the distress oil in the State had been cared for. The message to the Oklahoma Corporation Commission was as follows: "You are requested by the producers of crude petroleum in northeastern Oklahoma, in a meeting this day assembled, to make no order upon the pipe line companies purchasing crude in Oklahoma requiring greater takings of crude oil in the Oklahoma City Field and the other flush areas in the State until and unless all crude in the distress areas of the State has been provided with a market. Any order requiring greater takings of crude from the flush pools of the State will cut off the opportunity of the operators in the distress areas to procure a market and result in distress to thousands of oil field workers."

It was developed in the course of the discussion that while the greater part of the oil distressed on January 1 by the action of the Prairie Oil & Gas Co. in ceasing to be a buyer of crude had been taken care of by other companies, the greater number of owners of the oil are still unrelieved and their properties greatly reduced in value by their inability to find buyers. In addition to 1,700 or more distressed wells in Osage, Washington, Nowata, Rogers, Tulsa and Wagoner Counties, the Brock Pool in Carter County, is practically shut in for lack of a buyer. The Amerada Petroleum Co. is the principal owner in that pool.

J. G. KERR DIES

CHATHAM, Ontario, Feb. 28.—John Garner Kerr, county judge of Kent County, Ontario, died recently at Nassau, Bahamas, where he had gone for a holiday trip. He was in his sixty-fourth year. Prior to his appointment as county judge, Mr. Kerr was a leading lawyer of Chatham and was prominently associated with the natural gas industry, having been solicitor for the Union Natural Gas Co. and a director of the Central Development Co.

R. B. WHITE TO HUMBLE

Robert Bruce White, formerly sales manager for the Valvoline Oil Co. with headquarters in New York City, has been appointed general manager of marketing of the Humble Oil & Refining Co. Mr. White, who is widely known in marketing circles, will have his headquarters at Houston, Tex.

OIL MAN'S CALENDAR

MARCH

10-12—Excelsior Springs, Mo., Western Petroleum Refiners Association, Elms Hotel.

11-13—Detroit, Mich., Michigan Oil Men's Association, Statler Hotel.

16-22—Los Angeles, Calif., second annual Exposition, Oil Equipment and Engineering Exposition.

17-18—Columbus, Ohio, convention, Ohio Oil and Gas Men's Association, Deshler Wallick Hotel.

19-20-21 — San Antonio, Tex., American Association of Petroleum Geologists, Gunter Hotel.

20—Los Angeles, Calif., Spring Meeting, A.P.I. Division of Production, Pacific Coast District.

23-24—Chicago, Ill., Independent Oil Men of America.

30-3—Indianapolis, Ind., eighty-first meeting, American Chemical Society.

APRIL

11-19—Detroit, Mich., convention, Aeronautical Chamber of Commerce.

13-18—Philadelphia, Pa., eighth annual convention and exposition, American Oil Burner Association, Ben Franklin Hotel.

15-16—St. Louis, Mo., first mid-year meeting, A.P.I. Division of Refining, Statler Hotel.

23-24—Cleveland, Ohio, semiannual meeting, National Petroleum Association, Hotel Cleveland.

MAY

4-9 — Charlotte, N. C., Good Roads Convention.

11-14—Memphis, Tenn., Natural Gas Department, A.G.A.

19-21 — Tulsa, Okla., Natural Gasoline Association of America, Mayo Hotel.

27-29—New York, National Foreign Trade Council.

JUNE

3-4—A.P.I. Division of Production, Baker Hotel, Dallas, Tex.

15-18—Madison, Wis., fourth annual Oil and Gas Power Meeting, American Society of Mechanical Engineers.

READY MARKET IF NEW EASTERN GAS FIELD DEVELOPS BIG SUPPLY

CORNING, N. Y., Feb. 28.—Drilling for gas in southern New York and northern Pennsylvania has met with success on both sides of the state line. There is a well developed gas field in the Altay district, west of the city of Watkins, N. Y., and two gigantic gassers have been drilled in western Tioga County, on the Pennsylvania side, while wells are being drilled in Schuyler, Steuben and Yates County and a test is about to start drilling in Chemung County, New York. On the Pennsylvania side of the line a number of wells are being drilled in Tioga County, while leasing has been done as far east as Bradford County.

There is a very old oil pool at Gaines, Tioga County, producing Pennsylvania grade crude, which is being purchased by the Sinclair Refining Co. for its Wellsville, N. Y., refinery, and some oil is being produced in western Steuben County, which is a part of the Allegany Field, made up of a score or more of pools, all of them producing Pennsylvania grade oil. The discovery of gas in the Altay Field and the Tioga Field marks the most easterly oil or gas production in the United States.

The gas being produced comes from the Oriskany sandstone, which ranges in depth from 2,000 feet in the Altay area to about 4,200 feet in the Tioga area. Both the Tioga County wells found the big gas below the 4,100-foot level. The Oriskany sand is in the lower Devonian series.

The marketability of the gas produced in this region may be seen from the fact that Corning, the center of the gas region, is 200 miles from New York or Philadelphia and 160 miles from the Mohawk Valley around Albany. The cities of Syracuse and Utica, in New York State, and Scranton, Wilkes-Barre and Williamsport, in Pennsylvania, are all within a hundred miles of this city. The great industrial area in New England is nearer this gas field than some of the cities which will be provided with gas from the Texas Panhandle fields. There can be no question of a market if this field develops a production big enough to warrant extensive gas pipe line building.

The conclusion which has been drawn from the report herewith given by a prominent geologist operating in this field is in the form of a statement. It is especially significant of the future of industry in this field. He says:

Results Thus Far

"There are now four wells in the Tioga, Pa., area of the Corning region that would have initially produced 153,000,000 cubic feet of gas. A territory 7 miles long and 2 miles wide has been proved. The intensive drilling planned by Benedum & Trees, J. C. Trees, Allegheny Gas Co., Penn United, Trainor Brothers and others will provide at least 90 locations at 100 acres each."

The report starts with a review of the signal success of the Belmont Quadrangle Corp. of Bradford, Pa., which has 14 producing wells in the Altay Field. The total shutin production of 17 wells drilled in that field is in excess of 100,000,000 feet of gas per day. Fifteen wells of the Altay Field are capped. The average initial yield of each of the 17 wells of the Altay Field was 6,500,000.

Between 3,000,000 and 4,000,000 feet of this gas are being used daily under a 230-pound pressure through the pipe lines of the Home Gas Corp., owner of a filter and scrubbing plant and pipe line from Albany Field to Horseheads and Dundee. This gas is being used in Altay, Dundee and Horseheads. The line of the Home Gas Co. connects with the line of the New York Transit Co. at Horseheads.

Two pipe lines of the Transit company are now either leased or owned by the Columbia Gas & Electric Corp., which controls the Reserve Oil Corp. It is rumored, says the report, that Columbia Gas & Electric has received permission to use the New York Transit right of way for three new 18-inch pipe lines.

Fourteen of the Altay wells are owned by the Belmont Quadrangle Co., one is owned by J. E. Carpenter and two others by the Tyrone Oil & Gas Co. The field was started on October 15, 1930. Belmont Quadrangle has drilled one dry hole at Rushville, work having been stopped in the Medina sandstone.

Drilling Operations

The Lycoming Natural Gas Co., of 545 William Penn Way, Pittsburgh, Pa., holds leases in the Farmington and Sabinsville, Pa., and Woodhull, N. Y., areas. It is drilling two wells in the Farmington area, one in the Sabinsville area and one in the Woodhull area.

The Fenner Taft well of this company, located near Woodhull, Steuben County, is down 4,000 feet. The Ackley well, Sabinsville, Tioga County, Pennsylvania, is down 3,800 feet. The well on the Josiah Howe farm, at Farmington, is reported dry at 3,981 feet and the Shoemaker well, East Lawrence, at 3,781 feet. Geologists have stated that they believe the late well was drilled into a saddle on the Sabinsville anticline.

The Penn Ohio Gas Corp. of Pittsburgh, Pa., is drilling in the Tioga area in Pennsylvania on the Price farm at a depth of 2,200 feet.

J. E. Trainor and Art Herring of West Union, West Virginia, are drilling in the Tioga area, more particularly in Farmington Township. Their well on the Bostwick farm, Farmington, struck salt water on February 21. It is believed that this unfortunate circumstance was due to the slumping in the rock structure that made the Allegany No. 2 well a failure.

Trees' Big Well

J. C. Trees has one well in the Tioga area. This is located on the Farr estate in Lawrence Township. The well came in on January 25, 1931, at 1,000,000 cubic feet. Drilled in it recorded production at 15,000,000 cubic feet under rock pressure of 1,675 pounds at a distance of 6 feet in the sand. Albert M. Austin, representative of the company in this field, staked off five new locations for that company on February 21.

Paul G. Benedum of Elmira has four wells drilling in the field. Two on the Perkins farm at Addison reported at depths of 4,385 and 845 feet, respectively. His well at Elmira is 30 feet deep. The well at Alpine is 4,580 feet deep.

Mr. Benedum is also credited with ownership of the well on the Close farm, which started production on February 21 with a measured flow of 5,0000,000 feet. Six hours later, the report says, the well had increased in production to 22,000,000 cubic feet and on February 22 was reported to be producing 26,000,000 feet. It is now shut in.

Cady and others are drilling a well on the Kress farm 2 miles north of Watkins, N. Y.

J. Appleby and others are drilling between Dundee and Penn Yan, N. Y.

Cobble Hill Oil & Gas Co. has reached a depth of 900 feet on his well at Bradford, N. Y.

The Hope Engineering Co. and the Seger Oil & Gas Co. of Mount Vernon, Ohio, have reached a depth of 4,375 feet on the Bertch farm at Brookfield, Pa.

E. A. Williams and others of Bradford, Pa., brought in a well on the Husted farm at Woodhull, N. Y., at a depth of 960 feet which is producing 500,000 feet. This gas is said to be coming from the shallow Chemung sands.

The Reserve Oil & Gas Corp.'s official representative, Henry Wallace, Binghampton, is drilling two wells north of Ithaca, N. Y.

The Tyrone Oil & Gas Co. of Corning, of which Harry A. Erwin is president, has two wells near Wayne in Barrington Township, Yates County, New York. No. 1 is producing 723,000 cubic feet and No. 2, 3,500,000 cubic feet. This company is drilling another well on the Mary Gordon farm in the same territory.

John Cunningham of Rexford, Pa., finished a dry hole at a depth of 3,300 feet at Howard, N. Y.

J. F. Carpenter & Brothers, of Kittanning, Pa., finished two dry holes near Altay, N. Y., and have one well in that field producing 1,500,000 cubic feet.

The Leonard Oil Co. of Washington, Pa., is drilling on the Harrison farm in the Tioga area at a depth of 200 feet.

The Allegany Gas Corp. struck the initial well of the Tioga area on September 10, 1930. This was a wildcat venture. The well produced 22,000,000 cubic feet at a depth of 4,012 feet.

The No. 2 well of the Allegany Corp. on the Harry Kemp farm in the Tioga area was abandoned as dry at a depth of 4,470 feet after penetrating the Oriskany sand. It is believed that the bit penetrated a local slump in the Sabinsville anticline. Another location has been made 1,100 feet north of the discovery well.

The Adams Oil & Gas Corp. of East Charleston, Pa., is redrilling an old well on the E. Adams farm in the Tioga region. Redrilling was begun at a depth of 2,000 feet.

Trainor & Herring of Cleveland, Ohio, and Luffer Brothers of Syracuse are other operators in the section. Shannon Brothers of Brookville, Pa., have a dry hole at Constantia, Pa.

The Moserville Gas Co. has a rig up for a test just east of Elmira, N. Y.

WASTE GAS IS UTILIZED IN ALCOHOL PRODUCTION

(Continued from Page 186)

for liquid motor fuel, the French have turned to industrial alcohol. If it can be manufactured at a sufficiently low price, experts believe there is a prospect of it coming into wide use for motor purposes.

Officers of the National Research Council are now studying the economic possibilities of the process which has been developed. It is stated that operating cost, excluding overhead and any charges made for the waste gas required, would not exceed 25 cents per gallon. Industrial alcohol used annually in Canada at the present time is valued at more than $2,000,000.

How tremendous is the present loss of gas in the Alberta fields is indicated by the fact that the amounts of industrial alcohol mentioned would be produced, if the process is found practicable and put into operation, from about 10 per cent by volume or 20 per cent by weight of the total gases going to waste. At the last meeting of the National Research Council's associate committee on gas research at Edmonton in January, it was stated that a conservative estimate of the total gas waste would be 400,000,000 feet per day.

The senior chemist in the National Research laboratories doing research on the waste gas problem, Dr. A. Cambron, is said to have devised a process whereby this gas can be readily converted into another gas known as ethylene, from which it is an easy matter to manufacture industrial alcohol and a wide variety of other chemicals, including glycol antifreeze.

If only the stabilizer gases were used in the process, it is estimated that in their liquid form the amount of such gases available would total 1,200,000 gallons a month.

INFORMATION SERVICE

TYLER, Tex., Mar. 2.—J. S. Hudnall and G. W. Pirtle, consulting geologists, have instituted a geological information service of East Central Texas, and will have headquarters at Tyler, Tex.

The personnel of this service will consist of three geologists, namely, J. S. Hudnall, Chester Wharton and R. C. Lane, and in addition there will be two instrument men, one draftsman and one log plotter.

DRILL NEAR KANSAS CITY

KANSAS CITY, Feb. 26.—Frank E. Messler said today a deep test oil well to be drilled to the second stratum of the Mississippi lime will be spudded in tomorrow on the farm of C. C. Brillhart, 3 miles northeast of Lathrop, Mo.

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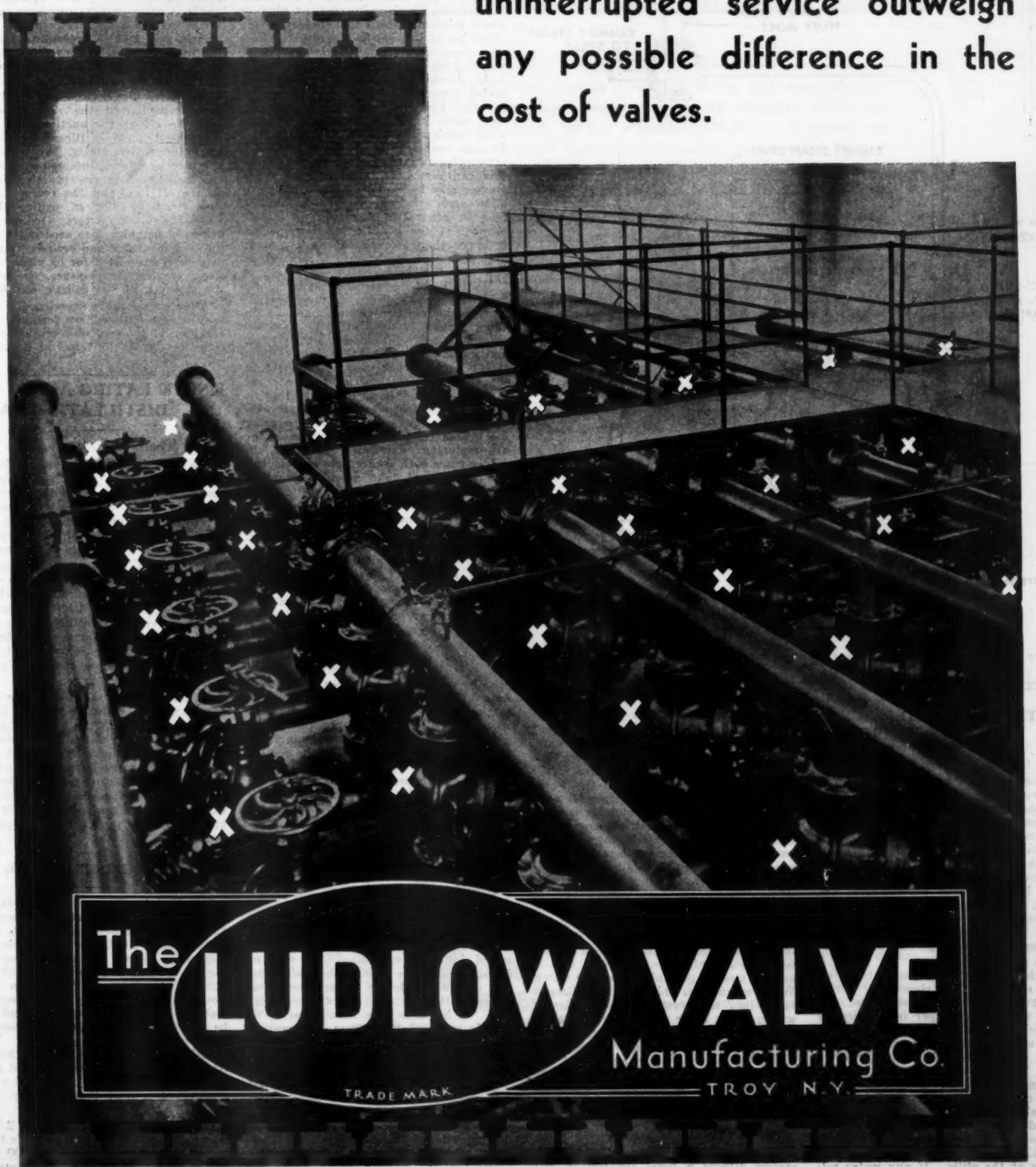

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UTILIZING EXHAUST STREAM IN REFINERIES

(Continued from Page 92)

the pressure of the steam prior to its admission to the still is of little significance. The difference in the total heat content of steam at relatively high and low pressure is so small that it can usually be wholly ignored. The small additional amount of sensible heat available in high-pressure steam is readily supplied by the still fires. The low pressures at which most distillations are carried out open this field to the ready use of exhaust steam.

Summary

As mentioned earlier in this article the tangible savings to be realized through the use of exhaust steam may be largely in fuel and water. Nevertheless, it is often possible to avoid investment in boiler plants through its use, either in construction of a new plant or at times of expansion. In these cases all saved capital charges, maintenance, commodity and operating costs are creditable to the system.

Whether or not an investment in an exhaust steam system is warranted will depend upon local conditions. The value of fuel, water, labor and possible savings in boilerhouse investment and operating costs must be balanced against the cost and maintenance of the low-pressure system. An economic analysis of each case will make possible an accurate estimate of the advantages to be derived through the utilization of exhaust steam.

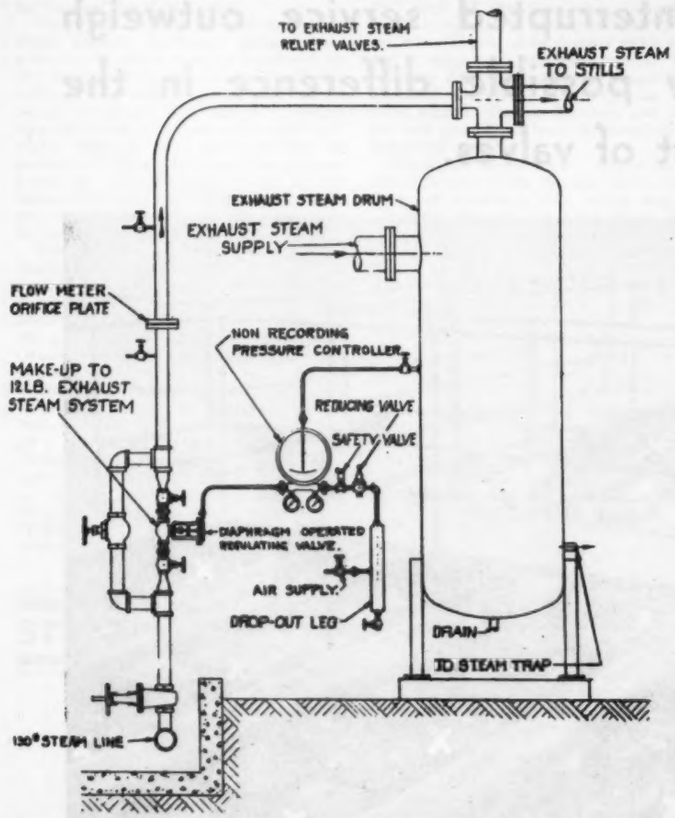

Figure 4—Arrangement for regulating the flow of steam taken from unit exhausts. Note safety provisions.

CONTROL OF MILD CASES OF CORROSION

(Continued from Page 98)

Matthews in the April, 1921, issue of Industrial and Engineering Chemistry; and consists essentially in breaking the emulsion by washing the oil with acetone, then washing out both acetone and salt with distilled water, which is then titrated with silver nitrate to determine the chlorides present. The volumes mentioned in the method as published are, 500 cc. oil, 125 cc. acetone, and 1,375 cc. water. A portion of this water solution is then tested and the results figured back to percentage on the original sample.

Another very practical test is to collect all the moisture which comes over during the regular laboratory distillation, and test it with litmus paper for acidity, or if sufficient is available, it may be titrated for acidity with a standard alkali soluiton, or for chloride with silver nitrate. This gives directly that portion of the sample which is corrosive. Qualitative tests are usually sufficient for practical purposes.

In addition to the tests made in the laboratory, it is usually possible to make tests at different points along the line of running at the stills. If any water settles out in preheaters and exchangers this is excellent for testing purposes. A very simple and practical test for this purpose is to filter a small portion of the water into a beaker, cover with a watch glass and heat gently till evaporated. The moisture which condenses on the watch glass is tested with litmus paper for acidity. The hydrolysis of chlorides is readily revealed in this test. Sometimes it is found that hydrolysis begins almost as soon as boiling. Again it may not appear till the salt crystallizes and the crystals are dehydrated. This brings up a very important point which can be verified at the stills. We usually think of the water being all gone out of the crude after we pass well beyond the boiling temperature of water. When we are considering hydrolysis, however, this is not the most important part of the water. When magnesium chloride crystallizes it takes into the crystal six molecules of water, or in other words the crystal of magnesium chloride is 53 per cent water. This crystal water is not released till the temperature reaches something like 350° F., and being directly attached to the molecule, it is the water which can most readily produce hydrolysis, or the forming of hydrochloric acid.

Point for Testing

Any point where water collects in the system affords a point for testing, but the final results may be summed up by testing the water coming from the tail pipe in the receiving house. Several tests are available for this. Tests for iron may be applied. This is a post mortem, and a positive test merely a requiem. Hydrogen sulphide is usually present in this water and after boiling it off the solution may be tested for iron by adding potassium ferrocyanide, or ferricyanide, or ammonia; each giving its characteristic precipitate of iron. Litmus paper again tells the tale and is simplest to apply. Even acid which has combined with iron to form chlorides of iron will show acid by the litmus test. This, however, is not true for methyl orange. Many corrosive conditions have no doubt been overlooked at this point by testing for acidity with methyl orange.

The presence of hydrochloric acid corrosion is usually revealed when condensers or vapor heat exchangers are down for repairs, by deposits of light blue or green products which may be tested for chlorides as previously described. These sometimes accumulate to the extent of stopping up passages, and sooner or later leaks develop at points where greatest action occurs. It is generally pointed out that hydrochloric acid does not corrode while in the vapor state but only when condensed and dissolved in water. In this connection errors may occur in attempting to predict at just what places this can occur. An exchanger, for instance, may be assumed to be too hot to allow such condensation, which may be true in general, and yet if the cooler member of the heat exchanging process is lower than 212° F. at any point it may cause condensation on its surface and thus localize corrosion.

Methods of combating hydrochloric acid have been outlined in numerous papers, including the use of ammonia in vapor phases of the distillation process, alkaline washes in condensing systems, and introduction of alkalies with the oil. It can be seen that in some cases where the amount of salt carried by the crude is excessive and hard to reach, that it might not be feasible to add alkali with the feed stream on account of producing too high a concentration of sediment, or ash-producing materials. However, in milder cases such as are here contemplated, it does not take much figuring to show that the amount of caustic soda, for instance, to react with all the chlorides present, would make no appreciable difference in the ash content of the residue.

For use in this manner, caustic soda is the best alkali for several reasons. Caustic potash would no doubt be as good or better except for cost. Hydrated lime is cheaper in proportion to its neutralizing power, but its use is less advantageous for several reasons. In the first place, its solubility in water is so low that it is hard to introduce in a steadfly proportioned manner without excessive introduction of water, or use of mixing devices to keep it mixed in a more concentrated form. In the second place, it cannot be made to contact the salt water drops as easily as the sodium compound, because the emulsifying tendencies of calcium and sodium in petroleum are opposite, hence sodium hydrate tends to break the emulsion holding the offending calcium and magnesium salts. In the third place, calcium hydrate could at best only handle the magnesium chloride, and the resulting product would be calcium chloride whose crystallizing tendencies have previously been mentioned.

Stopping Corrosion

For treatment of crude such as that described herein, it has been found that caustic soda of about 5 Be. gravity, mixed into the stream at the rate of about 1 gallon per 1,000 gallons of crude, will stop all evidences of corrosion mentioned, if the treatment takes effect properly. It has also been found that spent caustic soda solutions from the treating plant are just as effective as neutralizers, and perhaps superior from the standpoint of mixing with the crude. This comes from the fact that caustic solutions that have been used for some time on cracked stocks have a tendency to produce emulsions of the oil-in-water type, which are the opposite of those in crude oil, they being of the water-in-oil type. This shows that the emulsifying agents in the two cases have opposite effects on surface tensions of the two liquids, and hence tend to neutralize each other. This demulsifying action is an important factor since it causes a greater part of the water components to drop out in preheaters and exchangers where they may be drawn off before reaching the still. If all the salt water does not drop out however, it is important that a like portion of the caustic solution should also remain in the crude when it enters the still so as to be present when the dehydrating and hydrolyzing actions begin. In this respect the spent caustics are better than fresh clean solutions. So far as stopping chloride corrosion is concerned, it does not matter even if these spent caustics are sulphides, since the important part of the reaction is the conversion of all chlorides to sodium chloride. Hydrogen sulphide may be released in this case, but it is generally considered that hydrogen sulphide is not a serious corrosive agent at crude still temperatures, unless hydrochloric acid is also present to clean off the iron sulphides as they form and thus keep fresh surfaces of iron exposed to the hydrogen sulphide.

Proportioning devices are easily provided which feed the caustic solution into the oil at the suction side of the main feed pump. Blowcases may be used quite satisfactorily. A regulated air pressure may be maintained in the blowcase a little above the regulated pressure on the oil line, and the correct proportion fixed by size of orifice through which the solution enters. Ordinary variations in pumping rate need not be taken into consideration, and periodic variations may be compensated for by changing orifices, varying air pressure, or changing the strength of the caustic solution.

After considerable experience with the system here outlined, we feel justified in speaking of the cost of corrosion prevention literally in the terms of the apothecary.

KNOCK RATING AND DISTILLATION RANGE

(Continued from Page 98)

width and location of the gasoline referred to Gasoline A. The double horizontal lines show upon the right-hand scale the knock ratings of the gasolines expressed as octane numbers. The dotted lines show upon the left-hand scale the 10 and 90 per cent points of the gasolines.

The octane numbers of the gasolines vary from 50 for Gasoline M to 61 for Gasoline D. The results show that by sacrificing a yield of 24.9 per cent from the heavy end of Gasoline A, the octane number is raised 6 points while the elimination of 28.2 per cent of light ends from Gasoline A lowers the octane number 5 points.

In general, it is shown that the octane numbers vary systematically in the expected manner with the boiling ranges of the gasolines. As was to be expected, the highest octane number was found in the gasoline having the lowest 10 and 90 per cent points. There is no indication that any of the fractions used in blending the gasolines have any unexpectedly high knock-promoting or knock-suppressing properties.

OFFER BONUS FOR OIL

MINEOLA, Tex., Mar. 2.—Mineola citizens are willing to pay a bonus of $20,000 for a producing oil well. At a mass meeting $10,000 was subscribed and pledged to the oil contractor bringing in the first commercial oil well within 10 miles of Mineola and located in Wood County. The well must produce commercially for a period of 60 days and must be spudded in within 90 days from date of the bonus offer.

Malcolm Landers, president of the First National Bank of Mineola, posted a separate bonus of $10,000 for an oil well in a specified area of Wood County.

GREENVILLE, Tex., Mar. 2.—The board of directors of the Greenville Chamber of Commerce offered a $10,000 bonus for the first 200-bbl. oil well brought in within 15 miles of the city.

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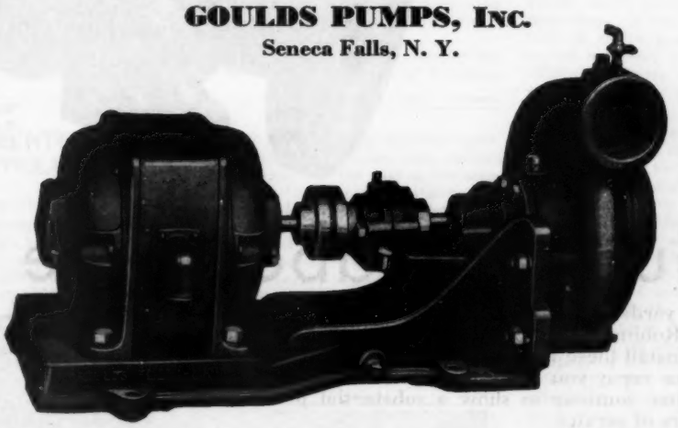

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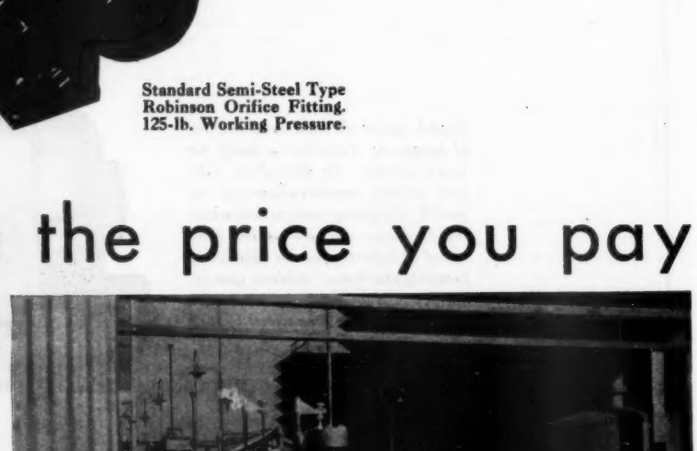

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NEARLY 13,500 IN SERVICE

DYES TO REDUCE LOSS IN ACID TREATMENT

(Continued from Page 133)

It was found that this could be done in general at far less cost than acid treating the gasoline to water whiteness, and the motoring public has taken to the idea. There are now on the market a large number of dyes which are suitable for coloring gasoline.

Care must be exercised in selecting the proper dye for the color to be obtained. This is largely a matter of experiment, and sometimes the experimenter gets surprising results. It has been found, in some instances, that a blue dye will give a red or green color when added to cracked gasoline. Some yellow dyes give orange, red or blue when dissolved in benzol, and then give an orange color to cracked gasoline. Some green dyes give yellow or orange when added to a cracked motor fuel. Some black dyes make cracked gasoline gray or brown, whereas some brown dyes give it a deep red color.

One of the most important money-saving possibilities of dyeing lies in the fact that gasoline with a light yellow cast can frequently be converted to water whiteness by the use of small quantities of blue dye. This is similar in principle to whitening sugar by the addition of minute quantities of ultramarine, and to the use of bluing in laundering white clothes.

For more than a year one company has been treating its cracked gasoline with a slight amount of blue dye. This brings the natural 21 color of the product to 27 or 28 on the color scale. When this product is blended with the straightrun gasoline made in the plant, it gives a final product of 30 color. The company ships this blend in tank cars to the trade. At its own retail stations, however, this refining company sells cracked gasoline alone, treated with as much blue dye as it will take without showing blue in the bowls of visible pumps. Thus, a few cents worth of blue dye is made to do as good a job or better than sulphuric acid, costing many times as much, to say nothing of the saving of gasoline losses and depreciation of knock rating which result from acid treating.

As an average it costs about 8 cents a barrel to treat cracked gasoline from its natural color to water whiteness, whereas dyeing gasoline costs about 0.4 cent per barrel, and, in addition, the knock rating of the gasoline is preserved.

Up to a certain point, said the manager of a refinery, the additional blue gives the gasoline a crystal white color. Beyond this point, it starts taking on a slight bluish tinge. Such gasoline, when ready for station use, although white to the eye, shows blue in the colorimeter. However, the additional blue gives room for some fading before loss of color becomes noticeable, and our experience has been that gasoline moves through the station pumps faster than noticeable fading occurs.

This company experienced some difficulty at first in getting just the right amount of blue.

"You can't judge by a 4-ounce sample or even by a quart sample," says the refinery manager. "I found it necessary to have some method of control. It was determined in the laboratory about the amount of blue necessary. This is mixed in a concentrated naphtha solution in the proper strength and is always on hand. The dye is mixed with the gasoline in a tank equipped with circulating lines and a circulating pump.

"A sketch of this layout is shown herewith. About 75 per cent of the determined quantity of dye solution is sucked into the pump through the funnel A, and the contents of the tank is circulated for about 30 minutes, after which we allow the 10-gallon bowl B to fill with gasoline from the discharge line.

"If this looks white but does not show a slight bluish tinge, about 10 per cent more dye is added and the circulation is repeated until a faint indication of blue is noticeable in the bowl. By the time this gasoline reaches the pump bowls it is a perfect water white. We use the same method in neutralizing gasoline we ship to 27 to 28 color, the only difference being that in that case the amount of blue is gradually added until the color machine shows an indication of blue, at which point it is necessary to stop."

A similar set-up would, of course, be good for any gasoline dyeing operation. Generally the dye is dissolved in benzol, and this is thoroughly mixed with the gasoline; e.g., 1 pound of a certain blue dye is dissolved in a barrel of benzol and this is then mixed with 1,000 bbls. of gasoline, generally by recirculating through a centrifugal pump until distribution of the dye is complete.

Extensive experiments were carried out at the Riverside laboratories of Universal Oil Products Co. at Chicago. Samples of red, yellow, brown, orange, green, blue, purple and other dyes, which were supposedly oil soluble, were obtained from leading dye manufacturers and jobbers in the United States.

Sixteen companies submitted samples of their dyes. The qualitative testing of the solubility of the various dyes has been summarized in Table 1. Approximately 2 milligrams of each dye was weighed and put into 100 cubic centimeters each of benzol, Pennsylvania cracked gasoline and a California straightrun gasoline. The samples were shaken at intervals for one hour. Any excess dye was filtered out and the clear solutions were exposed to sunlight on a tower for 50 to 56 hours. The benzol solution was not exposed since all the dyes were found to be soluble in benzol.

The course of fading, precipitation and settling out was observed from time to time. The total amount of sunlight each day amounted to about eight hours, these tests being made during August and September. The total number of hours of exposure, including darkness, was 56 for the straightrun gasoline samples and 50 for the cracked gasoline samples. If the color had not changed at the expiration of this time they were considered stable and marked plus 56 or plus 50 hours in the column of "fading time."

A number of the dyes were found to be insoluble in both the straightrun and cracked gasolines. In practically every case the solubility was improved by the addition of a third substance such as oleic acid.

Some of the dyes required large amounts of oleic acid to keep them in solution, while others required only a small amount. The addition of oleic acid was not a desirable feature, however, because of its acidity and gum-forming properties. Hence, the dyes which were soluble only under these conditions were not tested further for stability. In practice the employment of an unobjectionable third substance, such as a small amount of benzol, would permit the use of some of these dyes; in fact, this is general practice, as shown previously. However, it is not necessary to use dyes which are difficultly soluble or unstable in any degree, since many good dyes of all hues are available.

It will also be noted from Table No. 1 that some of the dyes did not impart the expected colors to the gasolines. Some of the greens produced orange or blue, some of the reds gave orange, some of the orange dyes produced red, and some of the browns produced red. There seems to be a larger variety of dyes for red and blue than for any other stock. Some of the green dyes were quite stable and satisfactory. With red, yellow and blue dyes available it is possible, by a system of blending, to obtain any shade desired.

Many of the red dyes tested were satisfactory. The same remarks are applicable to the yellow and orange dyes, particularly all of them being satisfactory with regard to both color and stability. A further test was made to ascertain quantitatively the amount of dye necessary to produce a satisfactory but arbitrary color.

Standard solutions of red, green, yellow, blue and orange dyes were made up to an arbitrary shade which in our opinion would be satisfactory when viewed through an ordinary visible bowl. Many dyes (Table No. 1) were weighed out and their respective solutions diluted until the color matched the arbitrary standard. The exact concentration of dye was calculated for each solution and the matched solutions were then exposed to the February sunlight for seven hours. The average sunlight available per day was four hours for this time of the year. The results of these tests are summarized in Table No. 2.

From these results it is found that the yellow and blue dyes are more stable in both grades of gasoline. Of course, it must be remembered that, although the time of exposure of these dyes was three times that given in the August and September tests, the total sunlight containing the full quantity of 7 per cent of

TABLE NO. 2.

	Pennsylvania Cracked gasoline			California Straightrun gasoline		
	Mgs. dye /100 c.c.	Lbs. per 1,000 bbls.	% Faded in	Mgs. dye /100 c.c.	Lbs. per 1,000 bbls.	% Faded in
REDS:						
Oil Red No. 13,044	0.38	1.33	100	.44	1.54	100d
Oil Red 3B	0.22	0.77	100	.30	1.05	100d
Oil Scarlet	0.34	1.19	100	.30	1.05	100d
Oil Red No. 322	0.30	1.05	100	.41	1.43	0d
Oil Red No. 1 Conc.	0.35	1.23	100	.42	1.47	100d
Oil Red L. A.	0.40	1.40	100	.47	1.64	0d
Oil Scarlet F	0.20	0.70	100	.24	0.84	100
Oil Red BB	0.34	1.19	100	.40	1.40	100d
Alizarin Rubinole Base R	1.00	3.50	0	1.10	3.85	100d
Oil Red Y292	0.41	1.44	100	0.45	1.57	0d
Oil Red O	0.26	0.91	100	0.35	1.25	100
Oil Red GRO	0.40	1.40	100	0.50	1.75	100d
Oil Red AB	0.28	0.98	100	0.50	1.75	100
Oil Red No. 282	0.29	1.02	100	0.41	1.44	100d
Oil Red No. 22,094	0.30	1.05	100	0.37	1.30	100d
Gaso Red No. 2,744	0.10	0.35	20*	0.10	0.35	100*
BLUES:						
Oil Imported Blue	0 60	2.10	0	0.40	1.40	0d
Alizarin Blue AS	0.50	1.75	0	0.40	1.40	75d
Oil Blue MG	1.00	3.50	0	0.70	2.45	75d
Gaso Blue No. 2,743	0.10	0.35	100	0.10	0.35	100
Gaso Purple No. 2,726	0.07	0.25	100*	0.07	0.25	100*
GREENS:						
Oil Green No. 422	2.00	7.50	100p	2.00	7.50	100p
Oil Imported Green	0.80	2.80	0	0.44	1.54	50d
Oil Green S	1.60	5.60	100p	1.60	5.60	100p
Alizarin Cyanine Green 3G	0.90	2 25	50	0.47	1 64	75d
Oil Green D3,180	2.00	7.50	100p	2.00	7.50	100d
Gaso Green No. 2,737	0.12	0.42	0*	0.12	0.42	0*
YELLOWS:						
Oil Yellow	2.00	7.50	0	2.00	7.50	25p
Oil Yellow GB	2.00	7.50	0	2.00	7.50	75p
Oil Yellow No. 2	2.00	7.50	0	2.00	7.50	0p
Oil Yellow No. 21	2.00	7.50	0	2.00	7.50	0
Oil Yellow AX	1.40	4.90	75	2.00	7.50	0p
Oil Yellow T	2.00	7.50	0	2.00	7.50	0
Oil Yellow No. 1	2.00	7.50	25	2.00	7.50	0p
Oil Yellow AG	1.48	5.20	0	2.00	7.50	0
Oil Yellow No. 21	2.00	7.50	0	2.00	7.50	0p
ORANGE:						
Oil Orange Ex. Conc.	0.40	1.40	100	0.40	1.40	75
Oil Orange 30	0 38	1.33	100	0.39	1.37	100
Oil Orange	0.50	1.75	25	0.60	2.10	0
Oil Orange AU	0.30	1.05	100	0.25	0.88	0
Oil Orange Base	2.00	7.50	0p	2.00	7.50	0p
Gaso Orange No. 2,735	0.15	0.53	100*	0.15	0.53	100*

*Only 53 hours' exposure.

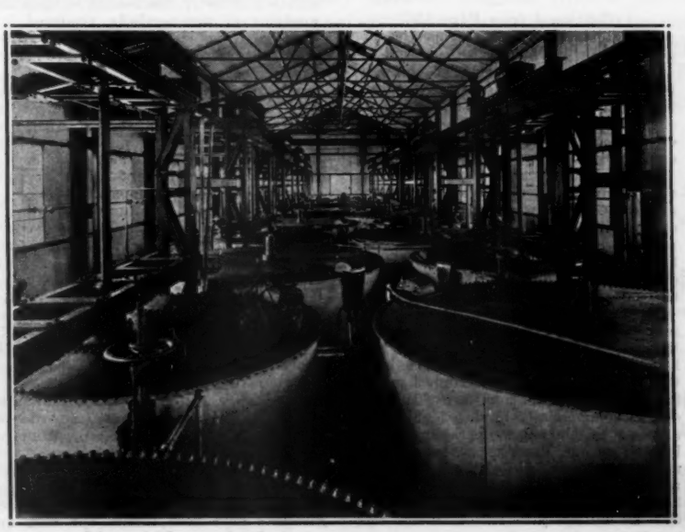
Key: 0, color was unchanged; 100, color was completely gone; d, deposit in bottom of bottle; p, precipitate floating around in solution.

CONTINUOUS COUNTER-CURRENT TREATMENT

(Continued from Page 96)

openings, while gas pressure equalizing lines, protected by gauge boxes, are provided. The plant is always full, so that breathing losses are eliminated, while, since the volume not occupied by liquid is very small, and is filled with a gas mixture above the explosion limit, fire risk is reduced to a minimum. The buildings in which the plants are housed are in fact free from any smell of spirit.

Considerable economy has been realized by these plants. In the case of kerosene, for example, the cost of treatment has been halved. In the case of hypochlorite-treated spirit a better product is obtained, with a saving in material and the great advantage that the concentration of the reagent is a far more flexible quantity than in batch washing. Several stages of alkali finishing treatment may be added, with the result that complete hydrolysis of any trace of acidic product is insured.



Interior view showing mixing and separating vessels of continuous spirit washing plant.

ultra violet radiation was about the same.

In solutions weaker than 2 milligrams per 100 cubic centimeters the dyes are less stable. The time that any dye would be exposed to the sunlight in a service station pump bowl would perhaps not exceed six hours at the utmost, and the average time would probably not exceed one hour. Under these conditions any of the dyes that were soluble in straightrun or cracked gasoline would be satisfactory for commercial dyeing of gasolines.

The number of dyes which are suitable for commercial dyeing is so large, and their chemical constitution so varied, that no definite relationship between constitution and suitability for dyeing gasolines can be given.

GASOLINE MADE FROM SIGNAL HILL CRUDES

(Continued from Page 136)

to the crude naphtha, it is probable that a portion of the hydrogen sulphide is decomposed with the formation of free sulphur, which, in turn, must then be absorbed by the addition of more sulphuric acid. This all tends to increase the difficulty of the treatment. Precaustic wash, on the other hand, easily and effectively removes the hydrogen sulphide with the formation of sodium sulphide. Sodium sulphide in turn will combine with small amounts of elemental sulphur and forms poly sulphides, thus removing from the

TREAT NO. 1
Caustic Washing Only

1 gallon per bbl. of 30 Be. caustic soda 10 min. agitation
Water washed 4 times with quantity equal to the gasoline
Strip—negative
Color — +28
Doctor—sour
3 hours in sun, +17, pink
3 hours in dark, +26, slight pink

TREAT NO. 2
Acid Treatment After Precaustic Wash

One-fourth lb. of new 66 Be. acid per bbl. with 25 min. agitation.
1 gallon per bbl. of 10 Be. caustic with 10 min. agitation
Water washed as before
Strip—negative
Color — +30
Doctor test —slightly sour
3 hours in the sun — +29
3 hours in the dark — +30

In order to show the difference between the treatment of crude naphtha with and without caustic washing, I give Treat No. 3, which shows the amount of acid used to get a stable product with no caustic wash.

TREAT NO. 3
Acid Treatment With No Precaustic Wash

3 lbs. of new 66 Be. acid with 25 min. agitation
1 gallon per bbl. of 10 Be. caustic with 10 min. agitation
Water washed as before
Strip—negative
Color — +30
Doctor test —sour
3 hours in the sun — +28
3 hours in the dark — +30

naphtha both the hydrogen sulphide and elemental sulphur. As is seen above, the gasoline is also increased in its stability, but even more than the increase of the stability is the increased ease with which the gasoline can be treated, and a stable product obtained.

Continuous Process

Treatment of the unscrubbed crude naphtha by the continuous process is difficult, as the quantity of acid required is large, and erratic results are obtained. After caustic soda scrubbing, however, the continuous treatment is fairly easy.

In our continuous treater, gasoline is taken from the storage tanks through a centrifugal pump. Sludge acid from the bottom of No. 1 tower is led into the suction of this pump. By controlling the valves on the gasoline and acid sludge lines into the suction of the pump, a mixture of approximately 33 per cent sludge is obtained. Intimate contact is obtained in passing through the pump, from which the mixture is discharged into the bottom of No. 1 tower, about 3 feet up. The sludge drops out and is again picked up with the pump, and the acid naphtha passes over into a second tower where most of the remaining sludge separates. A sludge level of about 3 feet is held in the No. 1 tower. The sludge is used till the gravity drops to 43-45 Be., then 18 to 20 gallons of fresh 66 Be. acid are added. The level in the tower is kept about the same by occasionally drawing off the sludge.

From the No. 2, or settling, tower, the naphtha passes into the bottom of the No. 3 rock tower. Nos. 3 and 4 rock towers are packed with about 3 feet of 1½-inch size granite rock. The naphtha passes into the bottom of one, out the top and into the bottom of the second tower. It then passes into Nos. 5 and 6 towers, which are packed with about pea size granite rock. The gasoline goes in series through these towers, and from there enters No. 7 tower. These rock towers act as agglomerators or collectors of the finely suspended sludge. The sludge collects in the bottom and is drawn off into the sludge accumulator. The naphtha from these rock towers has an acid odor, but contains no free acid. In No. 7 tower the naphtha is sprayed with a continuous stream of water, which, of course, is constantly drawn off the bottom.

Recently this wash was discontinued, and in its place a mixing chamber has been installed from the outlet of this tower into No. 8 tower. Twenty Baume caustic is pumped in continuously with the gasoline near the outlet of the tower and mixes through the baffle plates into the tower in which the caustic drops out and the gasoline passes over into No. 9, which is a settling tower. The caustic from the bottom of these towers is run into an accumulator tank and reused. The caustic requirement is small. In No. 10 tower a spray water wash is given the gasoline and from here it passes into storage.

Difficulty Experienced

Some difficulty was experienced due to the fact that if for any reason the charging pump was shut down momentarily the 30-pound preasure on the system forced the sludge acid back into the charging tank with serious results. A check valve in the line did not prevent this, so a trap large enough to hold all of the sludge in the tower was installed between the pump and the tank from which the charge was being taken. This eliminated the trouble entirely.

Representative operation of the continuous treater is given in Table No. 3.

TABLE NO. 3

Treated naphtha	99.68%
Loss	0.32%
Acid consumed per barrel	0.09lb
Caustic soda per barrel	0.03lb

The product obtained from the operation has the following properties:

Color	30
Color after 3 hours of sunlight	30
Color after 3 hours of dark	30
Doctor	Sw.
Corrosion strip	Neg.

HYDROGENATION AND GASOLINE CONSUMER

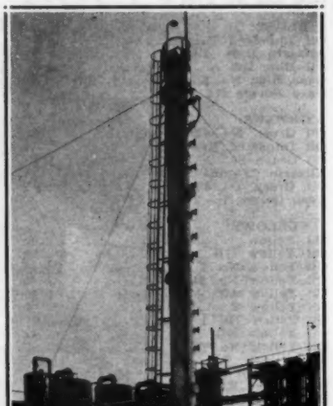
(Continued from Page 136)

practical standpoint, the properties of a gasoline or lubricating oil depend not only upon the three general characteristics already mentioned—purity, stability and homogeneity—but also upon the chemical structure of its prevailing type of hydrocarbon. That calls for some explaining.

The molecular structure of crude oils—or of any petroleum product, for that matter—covers a wide range through several distinct types of hydrocarbons, with room for an indefinite number of combinations in between. But for purposes of discussion we can consider only two, the paraffinic and naphthenic types.

In general, paraffin base lubricants are found to be more satisfactory for use in internal combustion engines, just as gasolines with a naphthenic base are better for the production of antiknock motor fuel. It is true that many paraffin motor oils as commercially produced at present are not as blameless in the matter of leaving carbon deposits as would be a naphthenic base lubricant. But the latter, on the other hand, shows a much higher rate of consumption and does not flow as uniformly at various motor temperatures.

By the hydrogenation process it has been found possible to combine the best features of both paraffin base and naphthenic base lubricants. Not only by all standard tests but by a new and exceptionally accurate instrument developed by one of the country's leading automobile organizations, hydrogenated lubricants are proven to be definitely superior in lubricating effect to any mineral product ever refined for lubricating purposes. They are characterized by generally high gravity, high flash and fire points, high color without excessive finishing, low degree of carbon residue and good temperature-viscosity index. The



Butane scrubbing tower for scrubbing high line cracking coil gas before delivery to hydrogenation plant at the Bayway, N. J., refinery of the Standard Oil Co. of New Jersey.

latter is the rate of change in the viscosity, or flowing properties, of an oil with variations in motor temperature. Hydrolubes are not only more stable than the general run of present day motor oils, but show a minimum variation in viscosity under the wide range of conditions in modern engine operation.

Perhaps the outstanding value of the process in this connection is its ability to turn out a premium quality product regardless of the quality or chemical nature of the charging stock which is fed to it.

Hydrogenated Gasoline

In view of the insistent demand for still more highly antiknock gasolines, together with the fuel problems of the aviation industry, the results of tests and analyses of commercially produced hydrogenated motor fuel have been awaited with natural interest. Based on data gained from these tests, it is not too much to predict even now that as soon as hydrogenation units of sufficient capacity are operating in the United States, it will be entirely feasible to satisfy demand for highly antiknock gasoline regardless of the nature of available crude oil or other charging stock.

Under present methods, naphthenic base gasolines are as a class less pure and stable than those of a paraffinic nature, although better from an antiknock standpoint. Hydrogenation, since it both purifies and stabilizes, eliminates both of these objectionable qualities, and at the same time shows itself capable of turning out a gasoline of an antiknock quality hitherto unattainable on a practical. commercial scale.

The knock rating of any gasoline is generally measured now on a scale of octane numbers. About 62 per cent of gasolines sold in the United States have a knock rating on this scale of somewhere between 57 and 63; only 6 per cent rate higher than 73. Hydrogenated gasolines have been turned out with an octane number as high as 95.

Formerly, perhaps the most familiar method of measuring knock rating was to take an average grade of good gasoline and give it an arbitrary rating of ten; then approximately 50 per cent benzol was mixed with this gasoline and the mixture assigned an arbitrary knock rating of zero. On this basis, most commercial gasolines rated between 5 and 12; premium fuels came in between 0 and 4. Hydrogenated fuels run down into the minus numbers—even as low as —15.

One of the most promising outlooks on hydrogenated gasoline is from the aviation standpoint. At present, in order to get high antiknock value in aviation fuels, it is generally necessary to use a product that is highly volatile. The lighter ends of such a gasoline have a low flashpoint—in other words, they are readily inflammable. The risk of fire, therefore, is not to be overlooked.

Antiknock Properties

The hydrogenation process obviates this entire difficulty through the fact that the heavier fractions of hydrogenated fuels have the best antiknock qualities. Consequently, it is not necessary to use a volatile, low-flash gasoline in order to meet the antiknock requirements of airplane engines. Another pecularity of hydrogenated gasoline is its high lead susceptibility. The improvement in knock rating obtainable from a given percentage of Ethyl fluid is much higher with hydrogenated gasolines than with the ordinary products.

When available to the motoring public in sufficient quantities, hydrogenated gasoline may be expected to allow the automotive engineer to build into his cars engines of higher compressions, operating at higher temperatures, and capable of greater speeds and greater efficiency. At the present time, the 5,000-bbl. plant of the Standard Oil Company of New Jersey at Bayway is the only commercial oil hydrogenation unit in the world in actual operation, and products from this, over and above those used for testing purposes, have been lost in the regular refinery output. Two other plants of similar capacity are approaching completion at Baton Rouge and Baytown, however, and it is planned to place a limited quantity of straight hydrogenated products on the market sometime this year. Full benefit of the new process to the motoring public generally will naturally depend on the rapidity with which other hydrogenation units are completed elsewhere in the United States.

BARBERS HILL CANAL

HOUSTON, Tex., Mar. 2.—An allotment of $25,000 has been granted by the Federal Government from the rivers and harbors funds to match a similar fund to be raised by Barbers Hill oil operators and other interests for the dredging of a canal to the field. The proposed canal will be 100 feet wide and 10 feet deep and will extend a distance of 11 miles from the field to a point on Cedar Bayou, a navigable stream. This canal will permit the barging of oil directly from the field into the Houston Ship Channel.

GULF OUT OF WEST COLUMBIA

HOUSTON, Tex., Mar. 2.—Gulf Production Co. has disposed of the last of its holdings in the West Columbia Field of Brazoria County, consisting of its 20-acre Hogg tract with two small pumpers, a warehouse and some other small buildings. This was purchased by Travis L. Smith of Houston. Gulf for some time has been gradually disposing of its interests there as it has not had sufficient interests to justify the maintenance of a personnel there.

BRITISH DISTRIBUTOR NAMED

Tide Water Oil Co. has appointed the Clarendon Petroleum Co., Ltd., of London, wholesale distributors of Tide Water lubricants in Great Britain. The Clarendon company will carry a stock of Tide Water products at various parts of the United Kingdom.

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29 Units were installed in the Mid-Continent field in 1929 by a single prominent pipe line company.

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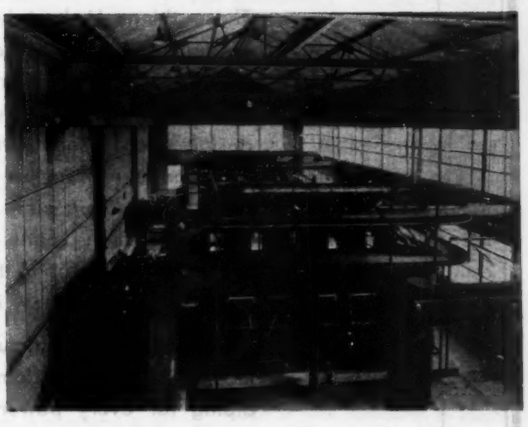

TAKING everything into consideration—initial investment, interest, amortization, fuel and lubricant economy, dependable operation, low maintenance and attendance cost, adaptability for moving from one station to another—good Diesel prime movers figure out commercially the most profitable and practical for the oil pumping station. That is why steam is being gradually but surely discarded for Diesel power in older pumping stations, and why Diesel power is used almost exclusively in the more recent developments.

To a very large extent, the McIntosh & Seymour Engine with its greater economies, extreme dependability and operating conveniences, is responsible for this transition.

The general design excellence of McIntosh & Seymour Engines, the well proportioned rugged parts, the durable materials and wearing surfaces, the simplicity of minor part renewals, the provision for sustained high fuel and lubricant economy, for easy interior access and inspections, the standardization of parts to reduce the number of spares that should be carried—all these superior features come from conscientious building, long experience and noteworthy achievements in every Diesel field. The McIntosh & Seymour Engineering Corps has had unlimited opportunity and facilities for initiating new developments, and for studying performance under a very wide range of operating conditions and has originated many Diesel engine improvements. In oil pipe line pumping, even the earliest installations of McIntosh & Seymour Engines are still operating with thorough satisfaction to their owners, and can hold their own against later models of any make. The improved McIntosh & Seymour Engine of today is therefore the dependable and economical unit for any pumping station.

Let our Engineers submit suggestions, costs, performance records and guarantees.

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Use Limbert to manufacture ordinary requirements or to design and manufacture special piping for every power plant or refinery condition.

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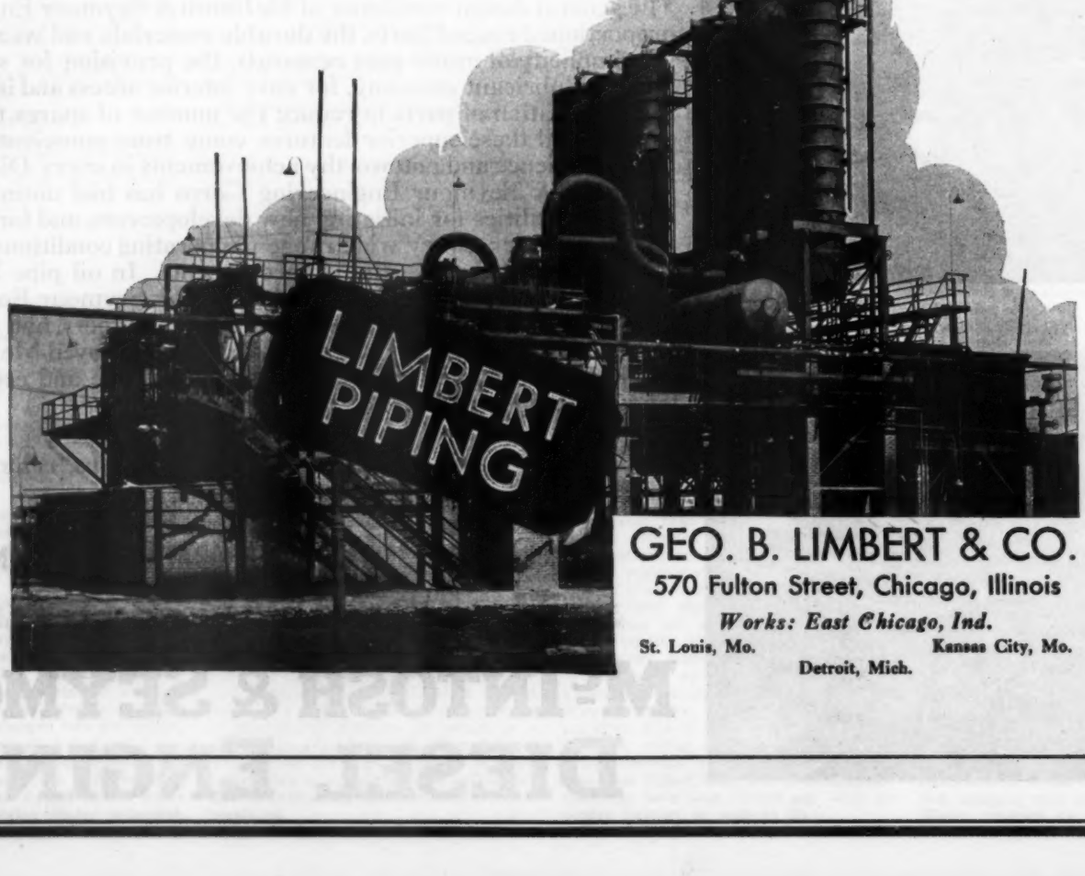

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Possible Synthetic Lubricating Oils

Must Be High Grade Compared to Petroleum Standards in Order to Justify Complex Technique Usually Required

By A. R. Bowen, Ph.D.*

PRODUCTS FROM COAL AND ETHYLENE GAS

The subject of the possible production of synthetic lubricating oils is reviewed. It is stressed that synthetic lubricants should be high class lubricants when compared with petroleum standards in order to justify the complex technique usually required. The best synthetic lubricants appear to be formed by the catalytic hydrogenation of inferior petroleum lubricants. Synthetic oils from coal and also from ethylene gas are reviewed as far as present information will allow and their inferiority to petroleum lubricants described. More experimental work is needed before many of these synthetic oils can command the attention of manufacturers.

Much interest has been shown during recent years in the subject of possible auxiliary sources of fuels and the production of synthetic liquid fuels, both light and heavy, has received considerable attention. It is now well established from the results of laboratory researches and experimental large scale plants that useful liquid fuels can be obtained in high yields from such substances as coal. In the past few years a large number of patents have appeared covering processes for the conversion of coal, heavy bituminous substances and tars into light spirits by treatment with hydrogen under high pressure, at elevated temperature and in the presence of certain catalysts. Brown coal tars especially have been studied intensively for spirit production by the I. G. Farbenindustrie in Germany.

The next step in the study of synthetic oils is the consideration of the possible sources of synthetic lubricating oils, of the possible production of the latter under similar conditions to the spirit formation and, finally, of the nature and properties of these oils when compared with lubricating oils produced directly from petroleum.

The latter point is of great importance as much experimental work in the past has been characterized by misleading descriptions of heavy, viscous fractions of tars as lubricating oils, when certain of their chemical properties would debar them from use in all practical lubrication conditions.

Fractions from low temperature tars have perhaps been the chief source of misapprehension in this connection. The whole subject of the composition of low temperature tars is complex, as the constituents depend on the nature of the coal from whence the tar was obtained, and upon the temperature and distillation conditions. Fractions of tar with similarity to petroleum fractions are obtained from the low temperature carbonization oils from oil shales and cannel coals, while brown coal low temperature tar appears to stand somewhere between the shale oils and low temperature bituminous coal tars, in properties.

Evaluation of Synthetic Lubricating Oils

At this stage it would perhaps be as well to accentuate the tests upon which a viscous oil should be evaluated as regards suitability as a lubricating oil.

1. Physical and chemical properties—Specific gravity, flash point, carbon residue, setting point.
2. Chemical nature—Whether pure hydrocarbon, saturated or unsaturated, whether free from acidic, phenolic, sulphur or nitrogen compounds.
3. Relationship of viscosity and temperature.
4. Relative stability to oxidation.
5. Friction reducing tendency.

These tests are significant and will be discussed in detail in turn. Specific gravity values, although no guide to lubricating powers, nevertheless throw some light on the chemical nature of the oils when considered in conjunction with viscosity. Some synthetic lubricating oils have specific gravities less and some greater than those of corresponding petroleum lubricating oil fractions. Flashpoint, carbon residue and setting point values are necessary when comparisons are made with petroleum oil standards. Chemical testing as regards general classes of constituent hydrocarbons is important, for example, the degree of unsaturation could be approximately estimated and also examination made for impurities such as acidic, phenolic, sulphur and nitrogen compounds. Temperature/viscosity relationships should be investigated when an oil is being evaluated, as some of the synthetic oils have much steeper temperature/viscosity curves than similar petroleum fractions. An example of this is furnished by the neutral oil from a low temperature tar from a cannel-type coal after the waxes had been separated.

Today, high class lubricating oils are required, in most cases, to have as flat a temperature/viscosity curve as possible.

Stability Under Oxidation

Stability under oxidation conditions is a property which should be investigated carefully with all synthetic lubricating oils.

Such a test will often demonstrate the unsuitability of a certain viscous oil fraction as a lubricant. An oil which is to be used in a circulatory system should be as little affected by atmospheric oxygen at the working temperature as is possible with hydrocarbon oils. Natural petroleum oils vary considerably in this property and the lubricants derived from paraffin base crudes are considered to withstand oxidation better than lubricating oils from naphthene base crudes.

The actual determination of the extent of oxidation in an oil is difficult and if not considered carefully can be misleading. It is general practice to estimate the degree of oxidation, after an oil has been bubbled with air or oxygen at an elevated temperature for a definite time, by the precipitation from the oil of the asphaltenes formed. With some synthetic oils asphaltene does not appear to be the major oxidation product, and an oil which from its sharp increase in specific gravity and viscosity and from the amount of water formed has obviously undergone extensive oxidation may not show weighable amounts of asphaltene. Probably the best estimation of the extent of oxidation, under certain standardized conditions, would include: asphaltene content determination, change in specific gravity and viscosity and also change in carbon residue value. Some oils, especially those derived from certain low temperature tars, which have been described as lubricating oils in the past, have been shown to form up to fifty times more asphaltene than a petroleum oil submitted to the same oxidation test. Friction reducing tendencies should be estimated preferably upon the machine for which the synthetic oil is considered to be a suitable lubricant, but, failing this, some laboratory friction testing machine operating under conditions of boundary friction can be used. Such instruments include the friction testing machines of Deeley and Herschel. A synthetic lubricating oil should give a friction value on these instruments not greater than those obtained with a well refined, straight, petroleum oil. Very low coefficients of friction are not necessary, as such values could be obtained if required, by judicious compounding with small quantities of fatty oils, or by the addition of traces of oil-soluble higher fatty acids such as oleic acid.

Many lubricating oils on the market are straight petroleum oils and compounding or germ processing to give more oily lubricants is only resorted to when oils have to function under special circumstances of heavy loads or high working temperatures, or where emulsifying properties are necessary.

Combination topping and cracking units at Okmulgee, Okla., refinery of the Barnsdall Refineries, Inc., with a rated capacity of 3,000 bbls. daily.

Synthetic Lubricating Oils

The oils to be described are those which have been obtained on laboratory or semi-commercial scale plant from the following sources.

1. From low grade petroleum lubricating oils—By catalytic hydrogenation.
2. From coal—By (a) low temperature carbonization, (b) hydrogenation of coal and coal tar, (c) catalytic hydrogenation.
3. From ethylene and other olefines—By (a) polymerization, (b) condensation with middle oils.

These processes, which have been suggested for the production of synthetic lubricating oils, will be considered now in turn.

Catalytic Hydrogenation of Low Grade Petroleum Lubricating Oils

This subject has been treated concisely by Haslam and Russell[1], who discuss the alteration of low grade lubricating oil distillates to obtain good yields of high quality oils especially as regards temperature/viscosity relationship, carbon residue, flashpoint and specific gravity. The process involves hydrogenation with high hydrogen under pressure at elevated temperature and in the presence of catalysts immune from the usual poisoning action of such substances as sulphur. These investigators point out that a modern motor lubricating oil should have, (1) as flat a temperature viscosity curve as possible, (2) a high flashpoint, (3) a low carbon residue, (4) a low setting point; and that although few normal petroleum lubricating oils meet all these requirements, hydrogenation, as described above, was investigated to attempt to combine all these properties in a lubricating oil. They summarize their results as follows: Hydrogenated, paraffinic type, lubricating oils with flat temperature/viscosity curves are characterized by unusually high flashpoints and low carbon residues, the latter laboratory tests being also borne out in actual engine tests. A wide variety of inferior lubricating oils have been found to be capable of hydrogenation to similar high quality oils, and a number of inferior lubricating oil distillates can be considerably improved by this process. From mixed base crudes, products can be obtained of highly paraffinic type. It thus is evident that of all the synthetic lubricating oils mentioned in this review these hydrogenated oils of petroleum origin will be the most closely allied to the high class petroleum oils obtained by the usual distillation processes.

Low Temperature Carbonization of Coal

Viscous oils boiling in the lubricating oil range have been described from German coal tars; they appear to be liable to cracking during ordinary distillation. However, it is stated that their viscosity can be regenerated by heating in an autoclave to 360° C. This observation suggests that these oils are more prone to decomposition and change with heat than petroleum oils. Lubricating oils from the high vacuum distillation of brown coal tars have been put on the market in Germany but such oils were definitely inferior in properties.

A lubricating oil has been described which had been derived from the tar from the low temperature distillation of a coal of cannel type. Mechanical friction tests showed that this oil lowered friction in a bearing under fluid friction conditions and behaved analogously to a petroleum product. Its behaviour under oxidation

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[1]Ind. Eng. Chem., 1930, 22, 1030.

conditions is not stated and this is unfortunate as, in general, the heavier fractions of low temperature tars form asphaltenes very readily. The specific gravity of this oil was nearly 1.0, which fact, taken into consideration with the general figure of 0.9 for corresponding petroleum oils, shows the low temperature tar lubricant to contain quite different chemical constituents from the petroleum oils. The viscosity of the oil fell off very rapidly with temperature, and compared with a petroleum oil of similar viscosity at 200° F., the tar lubricating oil had approximately twice the viscosity of the petroleum oil at room temperature.

It appears evident that oils which could be described as good lubricants have not yet been prepared from coal by low temperature carbonization. If carbonizing processes are discovered, in the future, to give stable higher fractions, there will still be the question of refining, since the lubricant fractions have to be freed not only from wax but from considerable proportions of phenolic and nitrogen-containing substances.

Hydrogenation of Coal and Heavy Coal Tar Fractions

The conversion of coal into a high yield of heavy tarry oil by the method of Bergius, by means of hydrogen under pressures of 100-200 atmospheres and at temperatures between 400-500° C., has been widely described. From the tar, viscous fractions can be obtained, but there is little data available concerning their nature. The oils when freed from phenolic and nitrogen compounds are probably largely hydrocarbon but whether the whole of this hydrocarbon content is saturated has not been established.

A certain amount of light on the constituents of the viscous oils from hydrogenation of coal has been provided by Spilker who hydrogenated, under Bergius conditions, not only coal tars but pure hydrocarbons representative thereof. The latter, which were higher aromatic hydrocarbons, gave fully hydrogenated derivatives which in some cases were viscous and chemically relatively stable. Their physical properties, e.g., specific gravity, about 1.0, showed them to be different from the usual constituents of petroleum oils, and this fact is supported by their ready dehydrogenation to the parent aromatic hydrocarbons. Further systematic study of these viscous hydrogenated aromatic hydrocarbons would be desirable, and oxidation and friction tests should be included.

Catalytic Hydrogenation of Coal

In the catalytic hydrogenation of coal and coal tars by the method originally developed by the I. G. Farbenindustrie, besides light spirits, some amounts of viscous hydrocarbons are formed. These will in all probability prove to be similar to the other hydrogenated coal hydrocarbons though perhaps somewhat more saturated than those from the non-catalytic processes.

Polymerization of Ethylene and Other Olefines

The investigation of the viscous oils produced by the polymerization of ethylene has been carried out recently[2]. Ethylene, a gas which can readily be obtained by the controlled dehydrogenation of ethane from, say, natural gas, or from the gas from vapor phase cracking units, can be readily polymerized under pressure at slightly elevated temperatures in presence of such catalysts as aluminum chloride or boron trifluoride.

At room temperature, the result of treating ethylene under pressure with aluminum chloride is a viscous free oil composed largely of hydrocarbons of the napthene series, and an oil which can be separated from an aluminum chloride/hydrocarbon complex, which is olefinic in character and which is considered to be an intermediate stage in the free oil formation. At higher temperatures, between 100-180° C., the crude oil from ethylene is lighter and besides light spirits of paraffinic nature and intermediate distillates it contains lubricant fractions probably of polynuclear naphthenic structure. As regards specific gravity and empirical chemical formula these oils bear some resemblance to petroleum lubricating oils but differ in having steeper temperature/viscosity curves and greater tendency to thicken when heated with oxygen.

The action of boron trifluoride has been studied by Hofmann[3] and his collaborators but little data on the oxidation tendencies of these oils have been given. The importance of the ethylene reaction lies in the fact that the conversion to heavy oils can be made almost quantitative and also that by suitably purifying the gas the products do not need refining after fractionation. Even after some oxidation these ethylene polymers do not appear to form asphaltenes but increase very considerably in specific gravity and viscosity. Their friction values on the the Deeley machine compare favorably with well refined straight petroleum oils.

Other olefines are doubtless amenable to similar polymerization reactions to yield viscous oils, and in this connection there are the patents of Allent[4] where viscous oils suitable for lubricants are described by passing olefine gases under pressure into suspensions of aluminum chloride, in light petroleum.

Condensation of Olefines with Middle Oils

When olefines such as ethylene are passed into middle oils (from coal tars) containing aluminum chloride, not only do polymerization processes take place, but also condensation between the middle oil hydrocarbons and the olefins[5]. It is suggested that the two reactions probably overlap, but the result is that a thin middle oil fraction from a coal tar can be converted to a highly viscous lubricating oil. Unfortunately there are no details available concerning the chemical and physical behavior of these oils, and it is very probable that they have many properties in common with the ethylene polymers. The reaction between ethylene and naphthalene is one which has been the subject of several patents. It is possible, by some extension or modification of the ethylene polymerization and condensation processes, that synthetic lubricants of useful characteristics may be obtained in the future.

Conclusion

It will be seen that the subject of the production of synthetic lubricating oils has been approached from several points of attack. In the past much misunderstanding has been caused by investigators describing as lubricants, all viscous fractions, without regard to their properties. The modern tendency of commerce to demand high grade lubricants must naturally be reflected upon these suggested processes for synthetic oils and it would appear that only those processes which produce very high class oils can expect to receive any consideration.

All the processes described appear to be some way yet from commercial development except perhaps the catalytic hydrogenation of inferior petroleum lubricants.

The synthetic oils from coal appear to contain a class of oils different in character from the constituents or majority of constituents in petroleum lubricating oils. The same remark applies to the polymerized olefine products, and more research is needed to determine the effect on the products of modifications in the processes already described. The condensation of ethylene with middle oils is indeed a line of research well worth investigating further.

This research is much hampered by our lack of knowledge of the pure chemistry of these high molecular weight non-benzenoid hydrocarbons. Until this knowledge is forthcoming, however, some useful information can readily be obtained by a study of the effect of various solvents on these different classes of synthetic oils, side by side with experiments on natural petroleum oils. Liquid sulphur dioxide, for example, divides a normal petroleum lubricating oil into an extract of more viscous nature, with greater unsaturation and of steeper temperature/viscosity curve than the original oil, and a nonsoluble oil of lighter viscosity and of greater stability and uniformity of properties.

In a complete examination of any synthetic oil it would be advisable to include tests for color reversion by some standardized heating method. Distillation should also be investigated as regards its effect on the stability of the oil, and indirect heating with mercury or diphenyl besides usual direct heating of the still.

[2]Nash, Bowen and Stanley, J. I. P. T. 1930, 16, 830.

[3]E. P. 293, 487; 313,067. F. P. 632,768.

[4]E. P. 202,311. G. P. 402,990.

[5]Krouch. Int. Conf. on Bit. Coal, 1928, Vol. 1, p. 39.

de FLOREZ CRACKING UNITS RUN TO COKE

(Continued from Page 95)

drum being in operation while the other is being cleaned and headed.

The absorption of the gases is carried out by recycle stock which has been cooled for the purpose of secondary reflux and which is readmitted to the fractionating system after having absorbed the gasoline from the gases.

Use Relatively Low Temperatures

The operation of the plant is extremely simple and flexible. In fact, it is possible to carry the operation out at temperatures varying from 1,000° to 1,070° F., depending on the character of the charge and the desired products. The characteristics of the coke are also readily controllable, it being possible to make hard coke with about 3 per cent volatile matter or a medium grade of coke with 10 to 12 per cent volatile matter. As mentioned above, this quality is controllable with the temperature in the coke drum.

The quantity of coke made, of course, varies with the charging stock although the quality may be maintained as desired. In stocks varying from a good quality of gas oil to 5 gravity cycle fuel the quality of coke remains approximately the same with proper operation, the only difference being the rapidity with which the coke drums are filled. Coke drums are normally filled to about two-thirds in height before switching, higher levels than this being undesirable on account of the tendency to prime into No. 1 tower.

The coke removal is effected by drilling a hole through the coke with a suitable drill bit and then rotating the drill head with chainknockers, thence it is removed to cars by adjustable conveyors.

In ordinary operation coke drums are cleaned and headed in 12 to 13 hours and the coke removal effected entirely by mechanical means so that no operators have to enter the chamber under normal operation.

High Gasoline Yield

One of the surprising features about the operation is the high yield of gasoline which is obtained from comparatively low grade stocks which appears to justify the use of the process in spite of the comparatively large amount of gas which is formed.

To date the unit has handled virgin Mid-Continent gas oils, reduced Darst Creek, light Humble and Caddo crude mixtures, as well as coke still cycle gas oils and heavy cycle fuel oil bottoms of about 5 gravity. In all instances the performance has been regulated toward the manufacture of a naphtha of approximately Ethyl Gasoline standard when running to an excellent grade coke.

The following information regarding the performance of the unit illustrates the flexibility of the plant and how it can be operated to meet varying market requirements.

Early Results

During an early run of 442 hours on a representative Mid-Continent gas oil, the conditions of operation were changed from day to day in order to determine the proper setting for the production of a high antiknock distillate. For the first days of the run, the furnace throughput averaged three and a half times the fresh feed with a heater outlet temperature of approximately 1,010° and a distillate production of from 75 to 80 per cent of the charge. The average performance for this period follows:

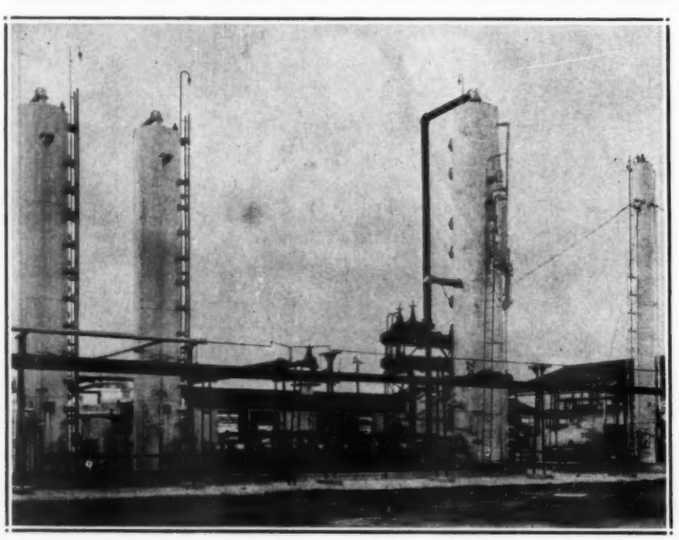
Heater outlet °F.	1,010
Charge bbls./day	1,510
Naphtha bbls./day	1,150
Recirculating rate bbls./day	5,400
Crack/pass	21.3
Yields, per cent:	
Naphtha	76
Gas	15.5
Test on naphtha:	
Gravity A.P.I.	56.5
Endpoint °F.	426
Octane No.	64
Fuel consumption, per cent	12.5

The heater outlet temperature was then gradually increased with accompanying decreases in the recirculating rate until the throughput averaged two and a half times the fresh feed. The following conditions prevailed during the final stages of the run:

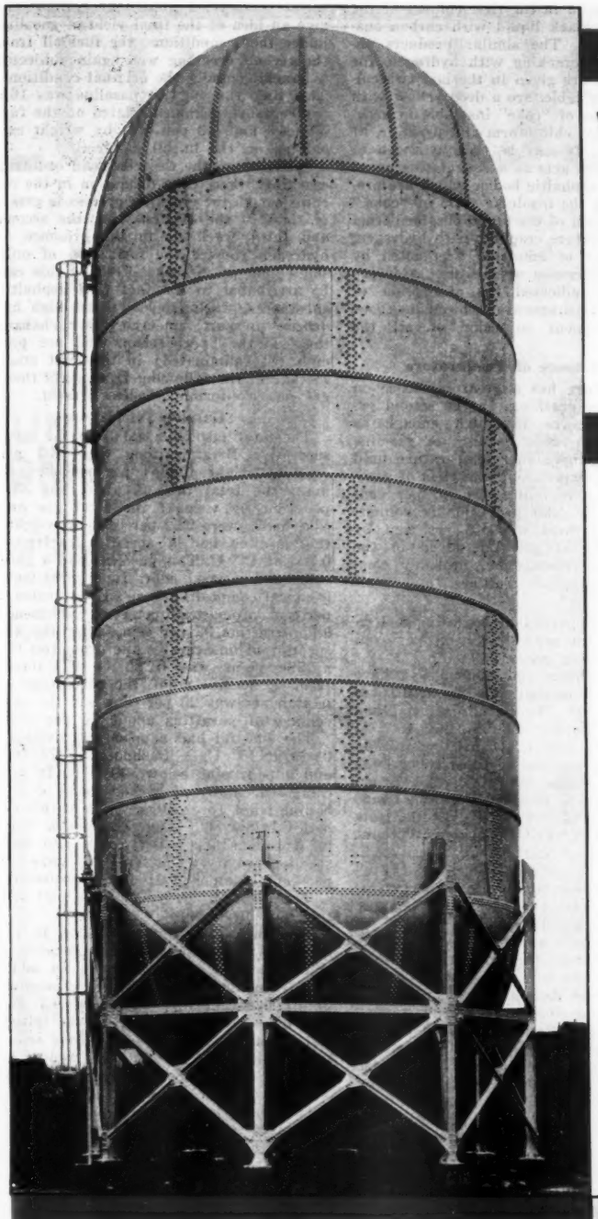
Heater outlet °F.	1,050
Charge bbls./day	1,510
Naphtha bbls./day	1,000
Recirculating rate bbls./day	3,840
Crack/pass	26
Yields, per cent:	
Naphtha	66.2
Gas	24.6
Test on naphtha:	
Gravity A.P.I.	56.2
Endpoint °F.	414
Octane No.	72
Fuel consumption, per cent	9.0

It is interesting to note from the above tables of comparison that the antiknock quality of the naphtha products improved considerably as the temperature and cracking per pass increased with, however, an attendant decrease in distillate yields which is to be expected with increase in gas production.

It is also to be observed that when the unit is operated at high temperatures for a maximum antiknock quality product that the fuel consumption is much less than what is required when running at



Vapor recovery plant of the Braun type at Houston, Tex., refinery of the Sinclair Refining Co.



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The High Pressure Tower shown in the illustration was designed and built for the Northern Indiana Power Company at Huntington, Indiana, to deliver 250,000 cu. ft. of gas between the pressures of sixty pounds and five pounds, and stands approximately 89′ 0″ high overall. A final test pressure of ninety pounds was held constant for a test period of forty-eight hours, allowance being made for rise and drop due to temperature conditions.

The illustration below shows a 300,000 cu. ft. "Western Gas" High Pressure Tower under construction at Streator, Illinois.

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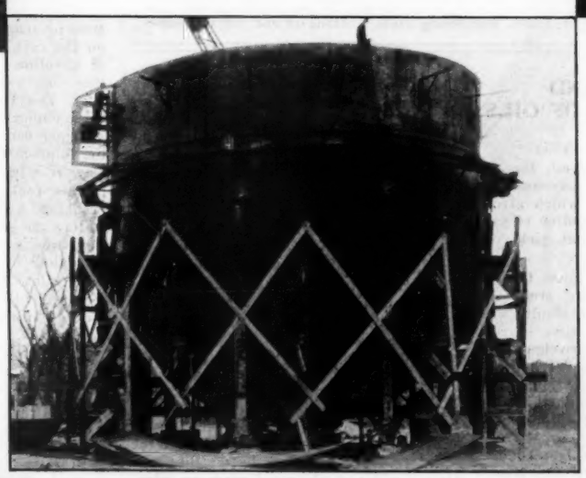

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relatively lower temperatures. Over 1,300 bbls. per day of endpoint distillate have been produced from this plant when processing Mid-Continent gas oil.

For the past four months the charge to the unit has been a reduced crude mixture of approximately 26 gravity. During a recent run of 420 hours duration, the heater outlet temperature and furnace throughput were likewise varied with consequent variation in yields and quality of product.

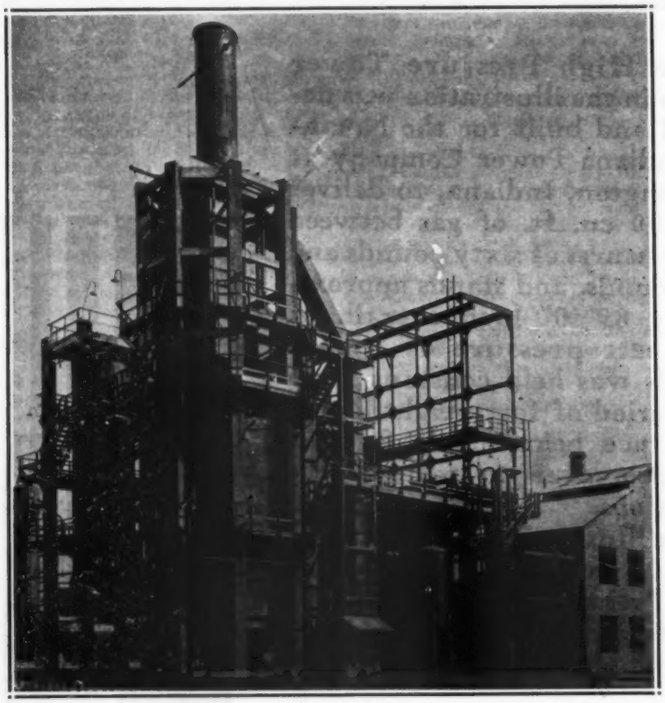
Below are average results covering four days' operation when making a naphtha having an octane number of 72:

Heater outlet °F.	1,030
Charge bbls./day	1,800
Naphtha bbls./day	1,205
Recirculating rate bbls./day	4,800
Crack/pass	25
Yields, per cent:	
Naphtha	67
Gas	20
Test on naphtha:	
Gravity A.P.I.	62
Endpoint °F.	398
Octane No.	72
Fuel consumption, per cent	10.74

When processing the same reduced crudes for maximum gasoline production without regard to antidetonating properties, considerably higher yields resulted at somewhat reduced temperatures with correspondingly greater furnace throughputs.

No unusual difficulties have been encountered when treating the high temperature distillates from this plant for gum and color. In fact, about 6 pounds of acid, sweetening and redistilling is employed to produce a stable gasoline having from 28 to 30 Saybolt color after 90 days' storage. The loss in antidetonating quality upon treatment is slight, averaging about 4 octane number.

Careful cost data are being compiled over an extended period of time which combined with operating figures will, in the future, permit an intelligent choice from an economic standpoint of operation to coke or liquid residuum.



General view of deFlorez cracking unit at Port Arthur, Tex., refinery of The Texas Company. In the foreground is the deFlorez heater. To the left of the heater is the coke drum and to the left, the gas separator, weathering drum, exchangers and control house.

HYDROGENATION AND CRACKING OF OILS

(Continued from Page 135)

catalysts: Paraffin wax, gas oil, topped crude, and asphalt. The yield decreases as we pass from paraffin wax which gives about 53 per cent yield of gasoline to asphalt which gives 20 per cent yield of gasoline[3].

Waterman and Perquin[4] have Berginized Rangoon paraffin wax studying chiefly the time factor. Their results indicate that with increase of time of reaction, the average molecular weight decreases, the tendency being to crack with gas as the ultimate product without the formation of polymerized products such as coke. The gasoline yield passed through a maximum of 52.8 per cent by weight and then decreased. The optimum conditions were: Temperature, 450° C.; time, 4 hours; initial hydrogen pressure, 110 atmospheres. Two hours' treatment was nearly as effective as four hours. Along with the gasoline there was formed 12.9 per cent of oil heavier than gasoline and 34.3 per cent by weight of noncondensible gas. No coke formation was observed. These authorities note that hydrogen saturates only the linkages broken during the Berginization without acting on double bonds if they are present in the initial material.

A. Szayna[5] gives a comparative study of cracking gas oil with and without hydrogen.

Initial material: Gas oil from Boryslaw paraffin asphalt base crude; specific gravity at 15° C. 0,861; bromine value 27; sulphur 0.57 per cent; formolite value 8.5; distillation begins at 225° C.; endpoint at 403° C.; dark brown in color; sulphuric acid (84.5 per cent) absorbs 4 per cent; sulphuric acid (98.3 per cent) absorbs 18 per cent.

As expected the gas obtained by cracking under high pressure and released after cooling contained no gasoline. On the contrary, much wild gas was in solution in the liquid (8.5 per cent loss by distillation). After distillation the gasolines were colorless but after several months' exposure to light in glass vessels, that from cracking without hydrogen became brown and gave a gum deposit; the gasoline from cracking in the presence of hydrogen became slightly yellow but gave no gum deposit. The unfractionated product obtained from cracking without hydrogen, for which data are given in the first column of the table, is a black liquid with carbon suspended in it. The similar products obtained from cracking with hydrogen, for which data are given in the last two columns of the table, are a deep yellow with a few grains of "coke" insoluble in gasoline, benzene, chloroform and pyridine, at the bottom. It may be that hydrogen in this condition acts as a coagulation agent on colored asphaltic bodies which are precipitated in the insoluble form of "coke." On distillation of the liquid obtained from high temperature cracking with hydrogen, the presence of ammonia was noted by the odor. Decrease of pressure after the experiment indicated the absorption of hydrogen. Hydrogenation brought about an improvement in color of all the products.

Importance of Temperature

Temperature has a great influence on the speed of cracking. In the second experiment it was not high enough as shown by the small amount of gasoline formed. By the higher temperature used in the third experiment, the yield of gasoline without recycling was 46 per cent by weight or 53.6 per cent by volume. In addition there was 8.5 per cent by weight of wild gases dissolved in the liquid before distillation, probably composed of propane, butanes, and some pentanes.

A. Nash[1] reports that according to Bergius, Mexican crude gives 45 per cent gasoline boiling below 210° C.

Ipatiew, Orlow and Bielopolsky[14] have hydrogenated mazout from paraffin base Grosnyj crude. The initial material had a specific gravity of 0.875 at 15° C., flashpoint of 126° C.; pourpoint at 135° C. Only 2½ per cent distilled below 300° These properties indicate an oil composed chiefly of paraffinic hydrocarbons. The authors have worked with catalysts such as Al_2O_3, Fe_2O_3, CuO and without catalysts. They stated that "these additions did not affect the yield at all." Under their best conditions, i.e., temperatures 455°-460° C. and time 1.1 hours, the yield of gasoline boiling to 150° C. was 34 per cent and the losses and permanent gas were 18 per cent. In one of their tests coke formation was noticed.

Ehrlich and Szayna[15] give a study of repeated hydrogenation of a crude topped to 220° C., Boryslaw crude which has the following properties: Specific gravity, 0.901 at 15° C.; viscosity 2.59° Engler at 50° C.; inflammable at 121° C. (open cup); pourpoint 126° C.; paraffin wax 11.5 per cent; this crude is of mixed paraffin-asphalt base and contains, in addition to hydrocarbons of paraffin series, a large amount of aromatics.

It will be noted that small changes in time or temperature have great influence on the rate of cracking, i.e., on the yield of gasoline, residue and gas. The gasoline obtained was colorless and of good odor. The average yield of gasoline from these experiments detailed in Table 2 was 26.6 per cent by weight or 33.5 per cent by volume. The average yield of fuel oil was 57.5 per cent by weight.

This fuel oil was again subjected to cracking with hydrogen under approximately the same conditions (the temperature was a little lower, i.e., 430-445°). The yield of gasoline was only 16.4 per cent, calculated on the fuel oil used, and 9.4 per cent by weight of initial material. In industrial cracking processes, the material is recycled about three times. To give an idea of the final yield of gasoline under these conditions, the fuel oil from the second cracking was again subjected to cracking under the original conditions. This time the yield of gasoline was 16.1 per cent by weight calculated on the fuel oil used and 7.3 per cent by weight calculated on the initial material.

Contrary to the experience in ordinary cracking, where coke formation in the rerun through the cracking process is greater than in the original run, the second and third crackings in the presence of hydrogen showed the formation of only small amounts of coke. Perhaps this can be attributed to the fact that asphaltic substances, when cracked under high hydrogen pressure, undergo other changes than do the hydrocarbons and are precipitated (eliminated) in the first stage so that in the following treatments there are no coke-forming bodies present.

Gasoline Yields

The total gasoline yield from the three successive Berginizations was 43.3 per cent by weight and 54 per cent by volume; the total fuel oil yield was 34.5 per cent by weight; the total gas and coke losses were 22.2 per cent by weight; the gasoline had a specific gravity of 0.723 at 15° C. This gasoline had a good color and a good odor. Its approximate chemical composition was: Unsaturates 3 per cent, aromatics 5 per cent, naphthenes and paraffins 92 per cent. After the absorption of unsaturates and aromatics the aniline point was 61.8° C. Calculated from the aniline point, the percentage of naphthenes was 25 per cent and the percentage of paraffins about 67 per cent.

The fuel oil had a specific gravity of 0.929 at 15° C., a flashpoint of 73° C., and a pourpoint below —18° C. It was composed chiefly of hydrocarbons of low boiling point (over 40 per cent of this oil boiled below 300° C.). The higher boiling fractions had low viscosity and high specific gravity. This fuel oil gave 10 per cent of an asphalt of high softening point (about 55° C. Kramer-Sarnow) and good ductility.

This fuel oil, after distillation to remove the asphalt, was again Berginized and gave on this fourth cycle an additional amount of gasoline corresponding to 4.1 per cent by weight and 4.7 per cent by volume calculated on the initial material taken. If this fourth cycle is included, the total amount of gasoline is increased to 47.4 per cent by weight or 58.7 per cent by volume.

The high yield of gasoline and small amount of coke obtained by cracking under high hydrogen pressure is due to the high hydrogen absorption which permits this favorable result from a heavy initial material.

Under the conditions described, the action of hydrogen is largely limited to the saturation of bonds freed in the moment of breaking of the molecule and thereby avoiding the formation of unsaturated compounds and in consequence preventing the polymerization leading to coke. Theoretically, by repeated cracking, we could get only gasoline and gases without any heavy polymers. Practically, in the initial material which is a natural oil-mixture, we always have (especially in the case of heavy oils) condensed aromatic hydrocarbons, aromatics with branched chains and asphaltic bodies. Hence we cannot obtain exclusively the two products, gasoline and gases, but also we must expect certain amounts of coke and residues of high specific gravity, i.e., exceeding 1. Probably even under the condition of cracking with high hydrogen pressure

TABLE 2

Run—	1	2	3
Temperature of reaction	435–450°	435–447°	435–452°
Time of reaction, in minutes	230	320	290
Pressure in atmos.:			
Initial	89	96	98
Maximum	222	235	245
After cooling	55	50	48
Liquid obtained, in pct. by weight	90.3	90.4	85.5
Gas, coke and losses, in pct. by weight	9 7	9 6	14.5
This liquid was subjected to distillation with a Glinski column.			
Yield of gasoline cut to 180° C. Endpoint 210°C.			
Pct. by weight reported to initial material	23.0	27.3	32 0
Sp. gr. of this gasoline at 15° C.	0.716	0.714	0 713
Pct. by weight of fuel oil	62.0	58.4	48 3
Its specific gravity	0.889	0.893	0.907
Pct. by weight of incondensible gas by distillation and losses	4.3	4.8	5.1

[3]Smolenski and Badzynski, Chem. Abst. 23, 2834 (1928).

[4]Waterman and Perquin, J. Inst. Petroleum Tech. 11, 36 (1925).

[5]Szayna, Ann. office nat. comb. liquids 2, 917-35 (1927). Szayna, Przemysl Chem. 11, 451-66 (1927).

[14]Ipatiew, Orlow and Bielopolsky, Brennstoff-Chem. 10, 346 (1929).

[15]Ehrlich and Szayna, Przemysl Naftowy, No. 11 (1930), and Petroleum Z. 26, 1043 (1930).

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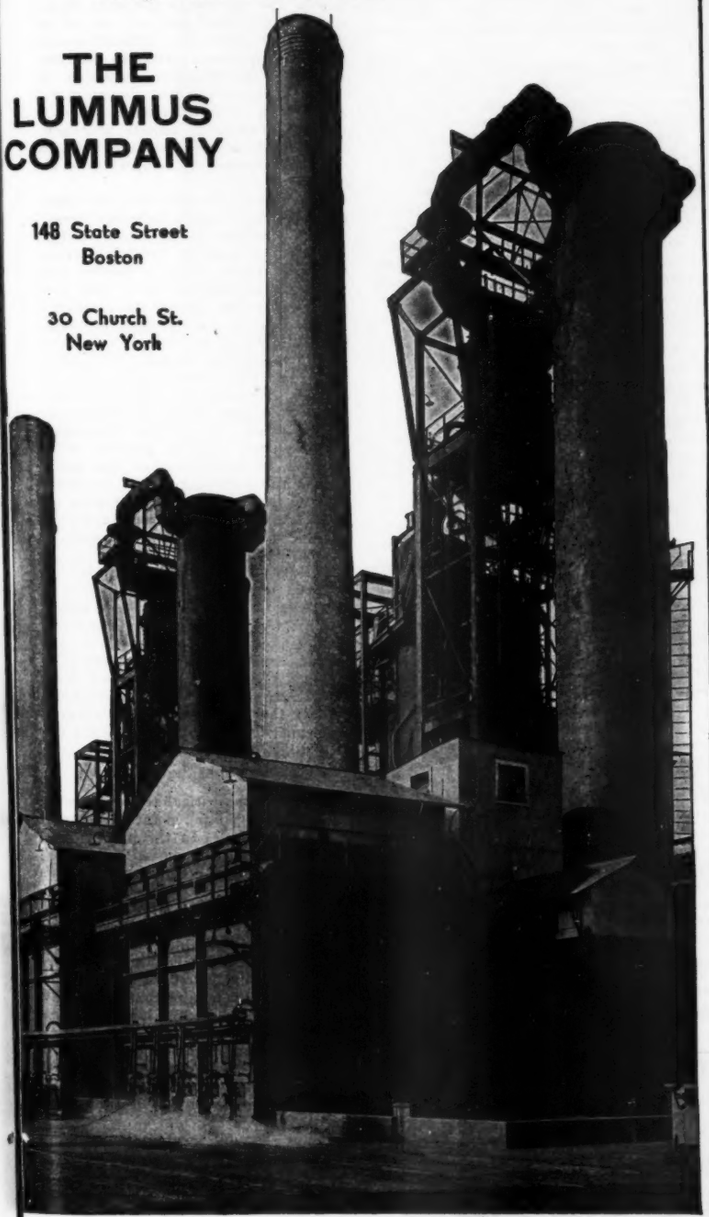

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some coke is formed from asphaltic bodies. Also oils of high specific gravity and low viscosity are formed from condensed aromatic-paraffin molecules by breaking them into paraffin hydrocarbons and the condensed aromatic ring compounds, which latter do not undergo cracking and hydrogenation within this range of temperature without catalysts and thus preserve their large molecules. This fact of the greater thermal resistance of aromatic compounds is well known in the cracking art.

Avoiding polymerization increases the yield of gasoline over the yield from ordinary cracking. Gasolines formed in an atmosphere of hydrogen are, of course, saturated and need but little refining treatment.

As shown in Sundgren's experiments[16], the ordinary cracking of decaline (dekahydronaphthaline, $C_{10}H_{18}$) under pressures of about 10 atmospheres gave a large deposit of carbon. When as low a pressure of hydrogen as 30 atmospheres was used, no carbon formation was observed. In these experiments we have a striking example of hydrogenation and simultaneous protective action of hydrogen gas at relatively low pressures, when, instead of the production of a large amount of carbon and methane, he obtained almost exclusively liquid products by cracking.

Hydrogenation with Catalysts

In the published literature there is little relative to the hydrogenation of petroleum oils in the presence of catalysts. E. Ferber[15] hydrogenated a transformer oil in the presence of a nickel catalyst under conditions analogous to the hydrogenation of vegetable and animal oils. The physical properties of the product were scarcely changed but the iodine number decreased from 16 to 7. The sludge test was also improved.

Ipatiew and his co-workers[3 7 17] hydrogenated pure hydrocarbons of the naphthenic and aromatic series using alumina with oxides of nickel, iron or copper. Aromatics were hydrogenated to naphthenes. Naphthenes opened the ring to give further addition of hydrogen.

Coal tar asphalt is difficult to crack under high hydrogen pressure. Hugel[13] used a temperature of 460° C. and 100 atmospheres initial pressure of hydrogen for 10 hours without catalysts. Distillation gave 57.5 per cent oil (distilled 50° to 400° C.), 15 per cent asphalt, 27 per cent coke and the losses were 0.5 per cent.

Hugel[18] also used metallic hydrides (NaH, KH and CaH_2) as catalysts at a temperature of 300° C., which is too low for cracking but sufficient to hydrogenate unsaturated material in the presence of catalysts. Using 100 atmospheres initial pressure of hydrogen, asphalt from coal tar with 7-10 per cent of sodium hydride gave about 30 per cent of a viscous liquid of strong green fluorescence, the rest being a solid. On distillation, this oil gave an excellent lubricating oil consisting chiefly of hydro-aromatic (naphthenic) constituents.

For the study of the influence of catalysts on cracking with hydrogen at high pressure, one of us[19] used wood tar as a material free from sulphur. Activated charcoal, alumina of special preparation, finely divided nickel (reduced from NiO), and zinc containing cadmium, alone and in mixtures, were used as catalysts. The amount of catalyst used was 5 per cent of the oil taken. With or without catalysts the results were practically the same both qualitatively and quantitatively. Nickel gave slightly more gas and coke. Alumina gave less phenols, which indicates its dehydrating action.

In 1930 at a German plant lignite tar was hydrogenated commercially with a volume yield of about 50 per cent motor fuel by a single passage through the apparatus. Operating temperatures were 450 to 500° C. and hydrogen pressure of slightly over 200 atmospheres was used. A "catalyst" was used, presumably to aid in changing the high phenolic content of the lignite tar to hydrocarbons. Note that the use of a "catalyst" neither reduced the operating temperature nor the needed hydrogen pressure.

In the study of influence of catalysts on pure cracking we are concerned with the decrease of the cracking temperature and the yield of gasoline. By definition, a catalyst does not react with the material but only aids the system to reach the true equilibrium by diminishing the chemical resistances. But in the case of hydrocarbons above 300° C., the real equilibrium is carbon and hydrogen and not gasoline hydrocarbons. In consequence, in spite of much research, no satisfactory cracking catalyst has been discovered which has a selective action, e.g., breaks the molecule in the middle giving less gases and more gasoline. We wish to emphasize here that aluminum chloride and other anhydrous chlorides are not strictly catalysts for cracking systems but give definite compounds such as $(AlCl_3C_6H_x)$[6 11].

Another difficulty in connection with using catalysts for cracking purposes is that the catalyst quickly becomes poisoned by carbon deposit and by sulphur. Finely divided metals are particularly sensitive toward poisoning.

Discussion

We wish to call the attention of the reader to the following items of interest though we shall not discuss them in detail.

When cracking under high hydrogen pressure, we can distinguish two chief reactions: Cracking and hydrogenation. Starting with a saturated material cracking must occur first to produce unsaturated bodies.

In the case of materials susceptible to hydrogenation, we observe polymerization and hydrogenation first and then later cracking. For example, in the case of zinc-cadmium catalyst and wood tar, at about 300° C. we observe a decrease of pressure which is due to absorption of hydrogen. This is followed by a higher rise in pressure than would correspond to the expansion of the hydrogen and in this period cracking occurs.

Under similar conditions we found that without catalysts and at higher temperatures, hydrogenation and cracking occur almost simultaneously.

Catalysts useful in this work may be of several types: Ferric oxide for removal of sulphur: finely divided metallic nickel and cobalt for hydrogenation at low temperatures but cerium, zinc, or a labil hydrogen compound such as sodium hydride is better because it is less sensitive to poisoning by sulphur; alumina for removal of hydroxyl groups; oxides of chromium, tungsten, molybdenum, cerium or zinc for increase of viscosity of certain kinds of lubricating oil, coagulation of asphaltic and coloring constituents and removal of hydroxyl group from phenols; for the removal of hydrogen, i.e., dehydrogenation of a badly knocking gasoline, the same catalysts may be used as in hydrogenation but in the absence of a heavy pressure of hydrogen.

The authors know of no catalysts which increase the yield of gasoline even slightly.

Gasolines made by cracking heavy petroleum oils with simultaneous high hydrogen pressure, with or without catalysts, are inferior motor fuels in that they knock badly in the motor, unless suitable initial material and physical conditions are used.

For good yields of gasoline by cracking in the presence of high hydrogen pressure, the favorable starting material is an oil of narrow boiling range and low in cyclic hydrocarbons and high in aliphatic hydrocarbons. Unfortunately not many such oils exist.

Favorable physical conditions are high temperature, high hydrogen partial pressure, reasonable time and not too low velocity of the oil over the heating surface.

The increased yield of gasoline by simultaneous cracking and hydrogenation under high hydrogen pressure is not nearly as large as popularly supposed[20] and is primarily due to the prevention of the formation of unsaturated bodies which, through polymerization, are the sources of heavy residues and of coke formation. Ordinary cracking processes average about 35 per cent gasoline yield by volume. By three successive treatments Berginization of most oils will give a yield of between 60 and 75 per cent by volume, by a single treatment about 50 per cent by volume.

In 1928 estimates made in England[12] showed that the amount of hydrogen needed to hydrogenate a long ton of coal was 135 pounds and the cost of this hydrogen was 30 shillings ($7.50). Petroleum oils take less hydrogen, say a fourth to a sixth as much, but there is relatively more hydrogen passing out with the hydrocarbon gases from cracking which probably cannot be recovered except at considerable expense.

The cost of gasoline by Berginization of petroleum oils will depend largely on the cost of hydrogen. Hydrogen for use in synthetic ammonia plants costs around 12 cents per 1,000 cubic feet. The lower permissible purity of hydrogen for Berginization of petroleum oils will reduce the cost of hydrogen from the same sources to probably 8 to 10 cents per 1,000 cubic feet.

If hydrogen is to be made, by the removal by liquefaction of methane and other constituents, from coal gas or a gas from vapor phase oil cracking or by action of steam at high temperature on light hydrocarbons, we are advised that the cost of the hydrogen may be expected to be around 15 cents per 1,000 cubic feet. If hydrogen is obtained by electroylsis of water solutions, then a cost of 20 cents per 1,000 cubic feet is about right.

From the data available the cost of the manufacture of gasoline by Berginization of petroleum oils may be estimated to be from 8 to 15 cents a gallon depending on the kind of petroleum oil used and the cost of hydrogen. This figure is based on the use of gas oil. If a crude oil or a fuel oil is used, the cost will be materially increased due to the larger amount of hydrogen used and smaller gasoline yield.

The problem of working in industrial size apparatus under high pressure and temperature was solved and satisfactory plants built for cracking oils, for ammonia synthesis and for methanol synthesis. The experience gained in these industries has been and will be of great aid in the even more difficult construction and operation problems entailed in the new industry under discussion. It is difficult and expensive, though not impracticable, to build pumps, valves and other apparatus to handle hydrogen at above 3,500 pounds pressure with parts of the apparatus at temperatures above 500° C.

The factor of concentration (partial pressure) has a great influence upon the rate of thermal decomposition of hydrocarbons. The gasoline formed is removed from the system before it reaches a high concentration and before it itself decomposes into gases. During the reaction hydrogen is used up and may decrease in partial pressure to such an extent that it will not exercise appreciable action in saturating the hydrocarbon radicals formed. This slowing down of the hydrogenation does not, however, simultaneously slow down the cracking. Theoretically the maximum yield of gasoline will be obtained by separation of the gasoline formed and recycling of the residual oil with the hydrogen which had been separated from the hydrocarbon gases with which it had become contaminated — an expensive process.

Hydrogen and oil under the high pressure and temperature of the system will ordinarily form a uniform phase which is neither strictly a vapor nor a liquid phase because the conditions are those above critical temperature of mixtures of almost all oils and high pressure hydrogen. McKee and Parker[9] have established the fact that the critical temperature of petroleum oils is a function of their average boiling point:

$$T_c = 105t_b + 160° \text{ C.}$$

where T_c means critical temperature and t_b the average boiling point expressed in degrees Centigrade. In the process under discussion the hydrogen will materially lower the critical temperature of the mixture.

Production of Kerosene

The process of simultaneous hydrogenation and cracking is adapted to the production of high grade burning oils (kerosene). If relatively low temperature hydrogenation with a minimum of cracking is used on a low quality lubricating distillate, a higher grade lubricating oil stock will result[8]. The process under discussion seems to be better adapted for the production of these products than for the commercial production of desirable gasolines.

Sulphur in oil treated is generally largely removed. That remaining in the gasoline produced is ordinarily so low as to permit the gasoline to be at once merchantable even if the charging stock was high in sulphur. With removal of sulphur there also is a decrease in gumming tendency and improvement in color.

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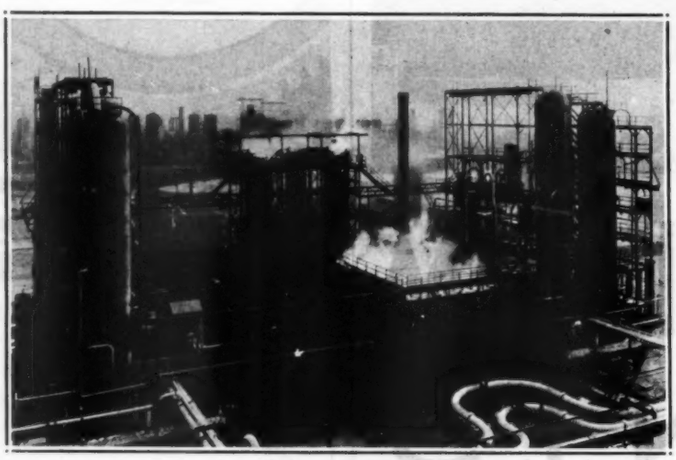

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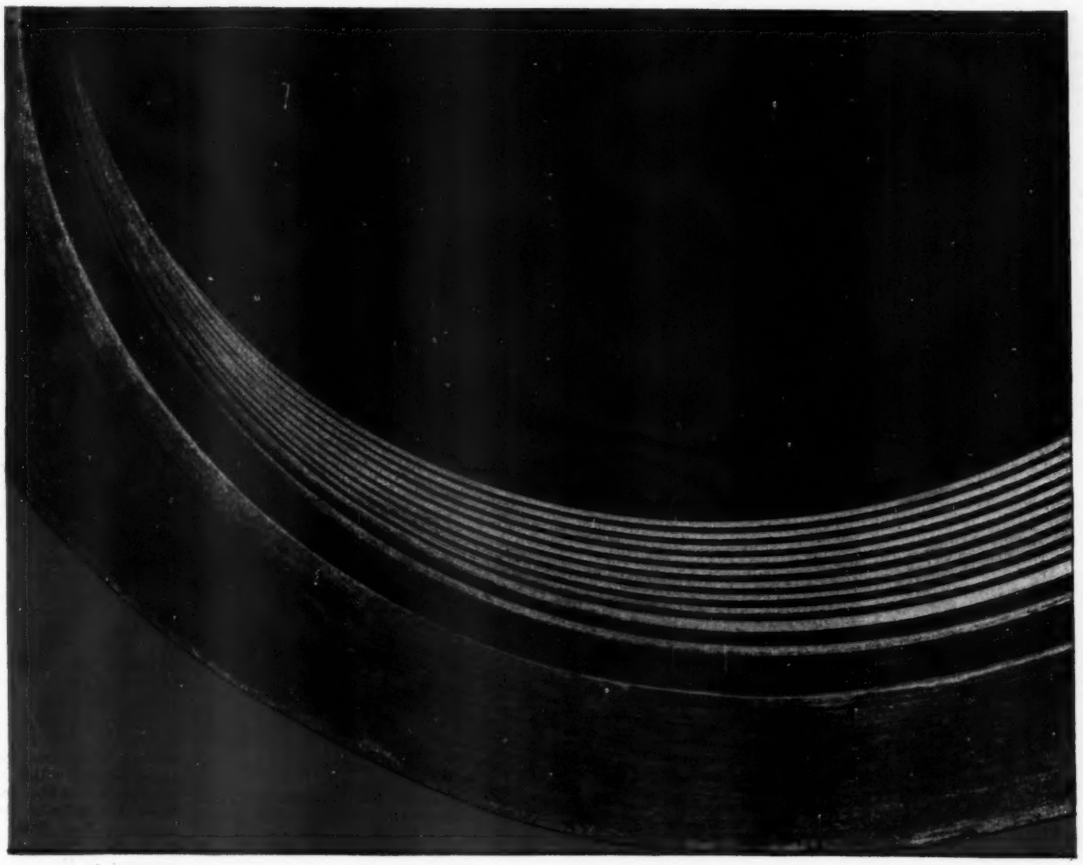

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SEASONAL GASOLINE CHANGES PRACTICAL

(Continued from Page 145)

is possible under steady driving conditions, Brown states[3], "the mixture temperature corresponding to 100 per cent effective volatility . . . plotted as a function of the 90 per cent A.S.T.M. temperature . . . was found to lie on a smooth line. . . . The same curve was also found to represent the relationship between the mixture temperature for 65 per cent effective volatility in an air-fuel ratio of 8 and the 65 per cent A.S.T.M. point." Consequently the relationship in Figure 4 shows the variation of 90 per cent evaporated temperatures with atmospheric temperatures to obtain complete effective vaporization in the manifold. Brown further states[3], "if the fuel is completely vaporized, the enriched mixture supplied by modern carburetors during the acceleration period causes loss in power and unsatisfactory performance, particularly when accelerating." It follows, therefore, that the relationships shown in Figure 4 when applied to the 90 per cent temperature represent minimum values below which the 90 per cent temperature should not go. Conversely, the 90 per cent temperature establishes the maximum atmospheric temperature above which the fuel will cease functioning without loss of power or decreased acceleration under steady driving conditions.

The very pronounced influence of automatic radiator shutters on these items of motor fuel performance is noteworthy in Figure 4. For example, a typical gasoline in cars with automatic radiator shutters will have good accelerating characteristics between atmospheric temperatures of minus 30 to 65, while the same gasoline in cars not so equipped will have good accelerating characteristics between atmospheric temperatures of 47 and 120. This will be referred to later.

By using Brown's relationship (Table 1B, reference 2) for the maximum permissible 90 per cent temperature it is possible to approximate the minimum atmospheric temperature at which excessive crankcase dilution will occur under steady driving conditions. This relationship is also shown in Figure 4.

Performance of Gasolines

Figures 1 to 4 permit the determination of motor fuel performance for a wide range of operating conditions. The references cited permit the determination over a much wider range. In order to compare the performance of specific gasolines it is necessary to limit the range of operating conditions to a few representative and critical factors. This is done in Figure 5, where the co-ordinates are the conventional ones of the A.S.T.M. distillation. The points at which the A. S.T.M. distillation curve passes through the several axes designate the degree of performance indicated. Ease of starting, warming up characteristics and steady driving performance can be determined by plotting the A.S.T.M. distillation on this chart. To determine vapor locking tendencies it is necessary to use the vapor pressure. For this purpose Figure 1 has been placed on Figure 5, with the result that the latter comprises a complete means of comparing performance of gasolines.

A study of Figure 5 shows that it is comparatively easy to obtain good performance for cars equipped with automatic radiator shutters, an efficient exhaust heated manifold hot spot and a carburetor with an efficient accelerating device. The composite January, 1930, gasoline drawn on Figure 5 shows easy starting at an atmospheric temperature of —5° F., no choke after two minutes at 5° F., and good acceleration with no loss in power between —30 and 67° F. Moreover, the estimated vapor pressure shows that vapor lock would be expected between 56 and 75° F. From these considerations, it would appear that the gasoline cited is a well-balanced winter fuel for cars equipped as described.

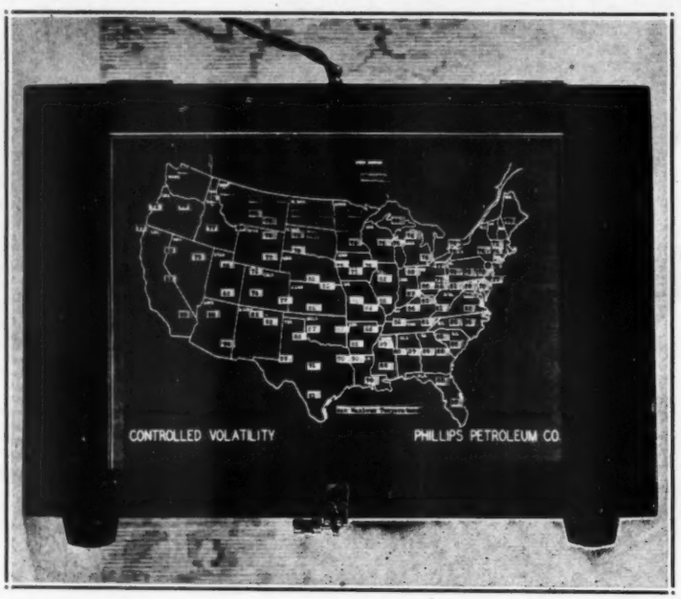

Figure 6—Seasonal temperature indicator.

Going to the other extreme and considering cars not equipped with radiator shutters, with less efficient manifold heating or less efficient accelerating devices in the carburetors, it is found that the composite January, 1930, gasoline offers difficulties in convenient and economical winter operation. Starting is still possible at atmospheric temperatures of —5° F., but it requires longer than two minutes to warm the manifold to the point where the choke is not required at atmospheric temperatures below 50° F. Furthermore, good acceleration with no loss of power is possible only at atmospheric temperatures between 50 to 100° F. The only remedy for these poorly balanced operating characteristics for the fuel in question is to enrich the mixture which, of course, is done at the expense of economy and crankcase dilution. Furthermore, it is difficult to persuade the motorist to make the necessary carburetor adjustments.

By depressing the A.S.T.M. 65 per cent temperature to 225 to 250° F. and maintaining the 90 per cent temperature between 350 and 375° F. gasolines can be made to provide both good acceleration and good economy without material carburetor adjustment for both types of cars for all usual winter temperatures. In obtaining this midcurve depression, it is essential that the vapor pressure of the gasoline be maintained at a value commensurate with the maximum atmospheric temperature to be encountered. An example of such an extreme winter gasoline is shown in Figure 5. Except in the very coldest weather, such a gasoline would require the use of the choke only while starting. In less than two minutes after starting at atmospheric temperatures above —10° F., no choke would be necessary. In cars without radiator shutters good acceleration with no loss in power or economy would be possible at atmospheric temperatures between 14 and 91. In cars with automatic radiator shutters the same performance could be obtained at all atmospheric temperatures up to 46° F. Cars with intermediate heating facilities would, of course, vary between these extremes. Vapor lock trouble would be expected in cars with poorly designed fuel systems at atmospheric temperatures between 49 and 59° F.

Table 1 presents test data and performance characteristics of 22 gasolines selected from an extensive survey to illustrate the extreme and typical fuels found on the market. As would be expected from the preceding discussion the conventional gasolines are very good as summer fuels but inferior as winter fuels.

Attempts to "spike" the front end for winter service result in unbalanced fuels, which vapor lock easily and require considerable carburetor adjustment to provide satisfactory steady driving performance. For example, extreme fuels of this type in Table 1 are represented by Nos. 2281 and 2194. The latter, with a Reid vapor pressure of 18.4 pounds, would cause vapor lock except at very low atmospheric temperatures in cars with very well designed fuel systems. Because of this limitation, the gasoline can be eliminated as a practical fuel. However, it is only at summer temperatures that both gasolines, with low atmospheric temperatures for vapor locking, give good acceleration, power and economy.

Lowering the 90 per cent point, and usually the endpoint, to compensate for winter conditions is ordinary practice and has several variations. The chief difficulty here is loss of accelerating ability and power in cars equipped with automatic radiator shutters. Unless the front end of the distillation curve is suitably lowered, ease of starting will be needlessly sacrificed. If the 65 per cent point is not sufficiently depressed, such fuels will require carburetor adjustment (at the expense of economy) to provide good acceleration and power at the atmospheric temperatures for which they are intended.

Examples of low endpoint fuels in Table 1 are Nos. 2273, 2518, 2316, 2159, 3348 and 3951. These six fuels fail to give good acceleration and power in cars with automatic radiator shutters at all but extremely low atmospheric temperatures. No. 2273 has so high a front end that easy starting is limited to temperatures above 40° F. The other five fuels have sufficiently low front ends to provide easy starting and reasonable warming up characteristics. In cars without radiator shutters these six fuels provide good acceleration characteristics at winter atmospheric temperatures, with the exception of No. 3951, which is so highly effectively volatile that loss of power is encountered even at extremely low atmospheric temperatures.

A comparatively new type of winter gasoline is now finding its way to the market. These gasolines have vapor pressures usually within seasonal limits, low midcurves and high 90 per cent temperatures. Examples in Table 1 of such gasolines are Nos. 3805, 3798, 3756, 3663, 3904 and 3877. The cold weather performance of these gasolines is admirably balanced. Ease of starting, warming up characteristics, acceleration and maintenance of power output under practically all conditions occur within the atmospheric temperature range of winter weather. Except for extremely cold weather, no carburetor adjustment is necessary in shifting from summer time use of conventional summer gasolines to winter time use of these winter gasolines.

From Table 1 it is apparent that conventional gasolines would perform very satisfactorily as summer fuels in all types of cars where the minimum atmospheric temperature to be encountered is about 60° F. These fuels also give very creditable winter performance in cars equipped with automatic radiator shutters, with efficient manifold hot spots and with carburetors having efficient accelerating devices. However, to provide equivalent winter performance in the

TABLE 1—COMPARISON OF ACTUAL, EXTREME AND TYPICAL MOTOR FUELS IN TERMS OF ATMOSPHERIC TEMPERATURES AT WHICH CERTAIN PERFORMANCE FEATURES OCCUR.

	TEST DATA														ATMOSPHERIC TEMPERATURES (°F.)					
															Cars with shutters			Cars without shutters		
S.S. Ident.	°A.P.I. Grav.	A.S.T.M. distillation data (per cent evap.) F.D.	5%	10%	20%	35%	50%	65%	90%	E.P.	Loss	Res.	Reid vapor Pres.	Vapor lock All cars	Vapor lock 90% of cars	Easy starting	No choke 2 min.	Good acceleration	No choke 2 min.	Good acceleration	Crankcase dilution
2281	61.5	85	95	112	143	216	299	331	365	427	2.5	0.9	*12.3	28	48	–15	14	21 to 67	53	79 to (†)	–20
3533	60.2	95	114	134	172	248	296	320	359	410	1.6	0.7	7.6	100	(†)	0	57	9 to 59	76	71 to 99	–30
1944	53.0	175	211	220	242	270	296	318	376	428	0.0	1.0	*1.5	(†)	(†)	73	78	7 to 83	94	69 to (†)	3
2194	63.6	82	...	89	134	199	266	314	371	424	9.0	0.9	18.4	(‡)	(‡)	–35	–11	1 to 75	40	67 to (†)	–8
2283	61.8	77	87	113	151	202	256	312	387	445	4.2	0.8	*12.3	28	48	–13	–6	0 to (†)	43	66 to (†)	26
2250	60.5	89	98	126	169	223	267	306	373	424	4.2	0.8	10.6	50	70	–4	27	–7 to 79	58	62 to (†)	–3
2056	57.6	105	145	169	205	239	271	304	375	428	0.4	0.6	*5.5	(†)	(†)	28	47	–9 to 81	70	61 to (†)	0
2033	58.3	106	131	156	190	225	255	286	352	404	0.8	0.7	7.2	(†)	(†)	17	30	–27 to 50	60	49 to 93	(§)
2848	62.2	100	122	136	161	198	240	281	367	422	1.3	0.9	8.0	92	(†)	5	–13	(§) to 70	40	46 to 100	–15
2273	59.3	126	163	181	204	230	255	279	330	386	1.0	0.6	*3.7	(†)	(†)	40	37	(§) to 20	64	45 to 78	(§)
2518	64.6	96	116	133	161	199	234	265	336	397	2.1	0.9	*8.5	83	(†)	4	–11	(§) to 28	40	38 to 81	(§)
3805	64.4	89	102	114	135	172	217	268	368	430	2.0	0.9	10.4	53	73	–11	(§)	(§) to 72	21	38 to (†)	–15
3416	63.4	94	112	129	155	190	226	258	348	420	2.1	0.9	9.1	73	93	0	–27	(§) to 44	34	33 to 90	(§)
3798	66.5	88	102	112	130	163	205	256	358	428	1.6	0.7	11.7	36	55	–13	(§)	(§) to 56	13	32 to 97	–30
3756	68.0	88	99	108	125	151	192	241	360	425	1.3	1.0	12.3	28	48	–15	(§)	(§) to 60	5	12 to 98	–27
2316	64.8	88	109	127	154	187	214	239	302	373	2.4	0.6	11.0	45	65	–2	(§)	(§) to –10	31	23 to 59	(§)
3663	68.0	92	103	113	127	153	188	237	351	411	1.7	0.9	11.4	40	59	–12	(§)	(§) to 47	5	22 to 93	(§)
3904	69.6	87	94	104	120	145	182	232	350	431	2.2	1.1	12.9	21	41	–19	(§)	(§) to 46	0	20 to 92	(§)
2159	54.0	106	132	148	167	182	198	226	313	386	1.6	0.8	*6.4	(†)	(†)	18	(§)	(§) to 1	29	17 to 66	(§)
3877	66.8	95	104	113	119	132	158	223	349	420	2.0	1.2	11.4	40	59	–12	(§)	(§) to 45	–8	15 to 91	(§)
3348	64.0	100	115	121	128	143	162	187	315	420	1.5	1.0	8.7	79	100	–5	(§)	(§) to 3	–2	–3 to 68	(§)
3951	75.2	102	117	123	139	140	154	174	223	316	0.7	1.2	8.0	92	(†)	–3	(§)	(§) to (§)	–3	–9 to 20	(§)

*Estimated. †Above 100° F. ‡Off chart. §Below –30° F.

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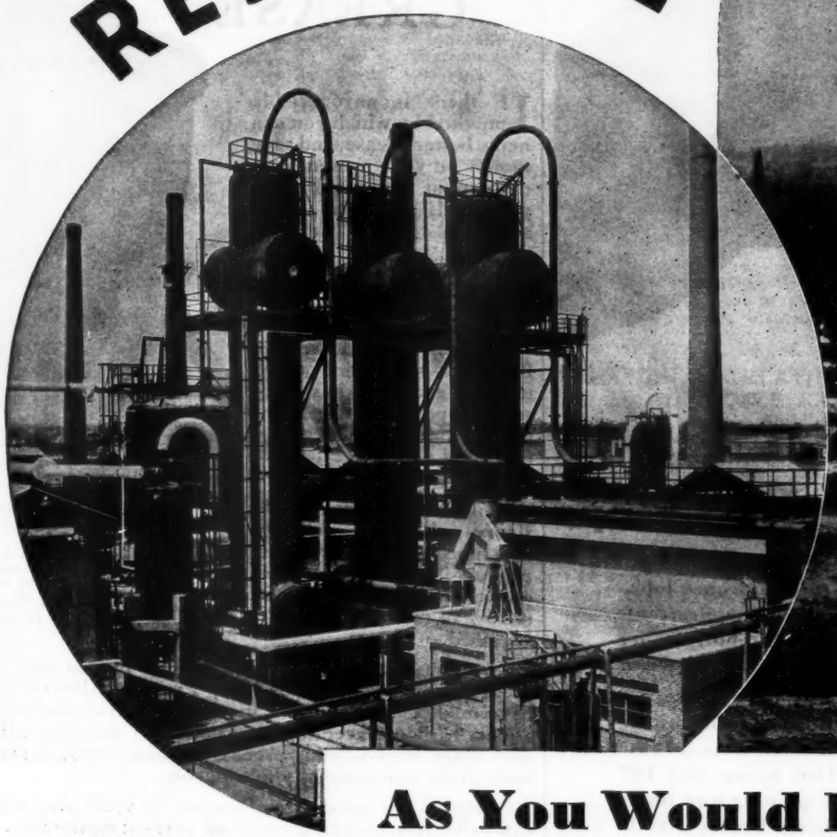

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Plymouth Bronzo Manila Bull Rope is made by the Plymouth Cordage Company—manufacturers of the world's finest ropes since 1824. That means that 107 years of experience in selecting and spinning rope fibers stand back of the quality of Plymouth Bronzo Manila Bull Rope. It means that our century-old reputation for quality and service must always be zealously guarded—and that by producing only the best—your fullest money's worth.

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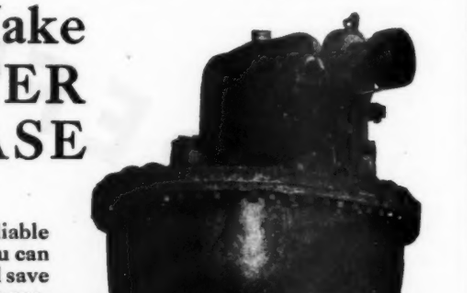

IF there is any reliable method by which you can make better grease, and save money on your present production at the same time, you will want to know about it.

A number of our customers have told us that pressure saponification of grease bases in Dopp Pressure Mixers has helped them to turn out better and more uniform grease; it has also made possible substantial savings in production time and labor.

In every case where we have obtained reliable figures, the same quantity of a more uniform or better product is now being turned out with a saving of from 60 to 75% of the time formerly required.

650 gal. Dopp Pressure Mixer built for a large grease manufacturer. Direct motor driven through V-belts and planetary spur gear speed reducer. Dopp Pressure Mixers are built to suit the conditions of the plant in which they are to be installed; motor, belt or chain drive can be provided for.

These facts explain why some of the largest and most important grease plants are installing Dopp Pressure Mixers. Where engineers have made careful investigations, they have come to the conclusion, almost without exception, that no longer can they afford to go along with older, time-wasting processes, since pressure saponification has been made commercially practicable.

To provide pressure saponification in your own plant requires no extensive re-arrangement of your present equipment. Dopp Pressure Mixers can be installed to work in conjunction with whatever types of open mixers you are now using.

In proportion to improvements and savings that you can reasonably expect, the investment is not large. Based on reports from some companies, their investment in Dopp Pressure Mixers will "wipe itself out" in a year's time or less, through direct savings in steam, power, time and labor.

We shall be glad to furnish further details on request; write for Circular No. 63, which explains pressure saponification as applied to lime soap greases.

Looking down into Dopp Seamless Jacketed Grease Kettle, with Style "D" Double-Motion Agitator. Scraping blades actually *scrape* kettle wall—speed up rate of heat transfer, and no soap can stick to wall to form lumps in grease.

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MANUFACTURERS OF DOPP EQUIPMENT FOR HEATING, COOLING AND MIXING

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NEW YORK BOSTON TORONTO

Seamless DOPP *Leakless*

more usual type of car it is desirable to depress the 65 per cent point of the distillation curve at the same time controlling the vapor pressure within seasonable limits. In its fuller meaning, this is what is meant by "controlled volatility" and seasonal gasolines.

There are, of course, narrower interpretations of the term, seasonal gasolines. One very vital interpretation at the present time is in regard to maximum permissible vapor pressures and maximum permissible 10 per cent evaporated temperatures.

Marketing Schedule

Some marketers seem to think that the distribution of seasonal gasolines is impractical. This is in face of the fact that it has been demonstrated[1] there is a decided and definite trend toward seasonal gasolines in respect to "front end" volatility of motor fuels. As a matter of fact, the gasoline surveys cited clearly show the number of unseasonable gasolines on the market to be negligible. In other words, gasoline marketers have been providing seasonal gasolines in a modest way. It is difficult to understand how any specifications, incorporating reasonable limits for "front end" volatility, should require any material change in existing practice. Moreover, it would appear that there can be no practical objections to a vapor pressure specification, provided the upper limit only was specified and if it were high enough to include practically all of the gasolines that are being satisfactorily marketed. In view of the fact that the design of automotive fuel systems can easily be revised to permit even wider limits than are now advisable, any specifications for present use should be subject to periodic review to permit the maximum flexibility to gasoline marketers.

Phillips Petroleum Co. is now in its fourth year of marketing seasonal gasolines, built upon the scientific precepts outlined in the first portion of this paper. The project has proven a success in many ways. Very little difficulty has been encountered in the problems of distribution. Very rarely, in a slow moving station, will there be sufficient carry-over of winter stocks to cause trouble in summers sales. Carry-over of stocks in the opposite direction is not so serious nor so probable.

To attain this efficiency in distribution, a very careful study of Weather Bureau reports was made. Particular attention was paid to the average maximum temperature as the most important limiting factor in regard to vapor pressure as a measure of vapor locking tendency. It was ascertained that with five seasonal grades of motor fuel, the average maximum temperatures of 85, 75, 65 and 45 made it possible with very few exceptions to carry only two grades at a time at the refineries in providing seasonal gasolines to the entire country.

A very convenient way of showing seasonal changes, such as average maximum temperature, is illustrated in the photograph presented in Figure 6. A table on rollers, controlled by the knobs, is so arranged that the average maximum atmospheric temperature for a designated interval of time shows in the windows, placed to represent the approximate centers of the 106 Weather Bureau sections. The particular table illustrated in the photograph is arranged to show average daily maximum atmospheric temperatures by weeks for the entire year.

As a result of this study, the five grades are designed for monthly average maximum temperatures as follows:

Grade 1, less than 45° F. (maximum shipping vapor pressure 13 pounds).

Grade 2, 45 to 65° F. (maximum shipping vapor pressure 11.75 pounds).

Grade 3, 65 to 75° F. (maximum shipping vapor pressure 10.50 pounds).

Grade 4, 75 to 85° F. (maximum shipping vapor pressure 9.25 pounds).

Grade 5, over 85° F. (maximum shipping vapor pressure 8 pounds).

Excluding Florida and the very southernmost parts of the United States, the above atmospheric temperature classification requires the use of only two grades at a time.

Five grades were decided on, rather than a fewer number, to obviate difficulties in distribution caused by the desirability of making state lines the boundaries of shipping territories and of making months the unit of time. Naturally, in considering a state as a whole for a month, the most unfavorable atmospheric condition must control the entire state for the whole month. With five grades available for distribution, the inequalities thus introduced are minimized.

With the preceding premises established the shipping schedules (Table 2) have put into effect.

B.—States, Alphabetically.

State—	(*)	State—	(*)
Alabama	15	Nebraska	10
Arizona	15	Nevada	12
Arkansas	15	New Hampshire	2
California	8	New Jersey	5
Colorado	4	New Mexico	15
Connecticut	2	New York	2
Delaware	5	North Carolina	14
Florida	16	North Dakota	1
Georgia	15	Ohio	5
Idaho	6	Oklahoma	15
Illinois	3	Oregon	5
Indiana	3	Pennsylvania	5
Iowa	2	Rhode Island	2
Kansas	13	South Carolina	15
Kentucky	13	South Dakota	2
Louisiana	15	Tennessee	14
Maine	1	Texas	15
Maryland	9	Utah	7
Massachusetts	2	Virginia	11
Michigan	1	Vermont	2
Minnesota	1	Washington	4
Mississippi	15	West Virginia	11
Missouri	13	Wisconsin	1
Montana	1	Wyoming	1

*Shipping schedule.

By making minor concessions to perfection in marketing seasonal gasolines it is possible to greatly simplify the above schedule so that it assumes the form shown in Table 3.

Even the simplified schedule, shown in Table 3, appears at first glance to be alarmingly complicated. Such has not proven to be the case. One very important factor is that each refinery has a natural marketing territory wherein freight rates permit it to compete most advantageously. Frequently this natural territory lies entirely within one, and at the most two of the territories designated as A, B and C, thus simplifying the problem of refinery stocks.

The desirability and economies of extending controlled volatility beyond the present usual practice of providing seasonal ease of starting is worthy of consideration. At the present time many premium gasolines are more effectively volatile than their companion nonpremium gasolines. In the summer time this difference is of no useful value. If it were possible to conserve this greater effective volatility for winter gasoline it is believed the general motoring public would benefit by the more consistent performance so obtained. Good roads and closed cars have increased the winter consumption of gasoline. Perfectly and expensively designed cars can minimize the need for seasonal gasolines, but the quality of the gasoline is the gasoline marketer's key to the economies of the situation.

TABLE 2—MONTHLY DISTRIBUTION PLAN FOR FIVE SEASONAL GRADES OF MOTOR FUEL

A.—Shipping Schedules, in Order of Decreasing Average Weighted Volatility.
(Numbers in Table Refer to Grade Numbers)

Shipping schedule No.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	States—
1	1	1	1	2	3	4	4	4	3	2	1	1	Me., Mich., Minn., Mont., N. Dak., Wis., Wyo.
2	1	1	1	2	3	4	4	4	3	2	2	1	Conn., Iowa, Mass., N. H., N. Y., R. I., S. Dak., Vt.
3	1	1	1	2	3	4	4	4	3	2	2	2	Ill., Ind.
4	1	1	2	2	3	4	4	4	3	2	2	1	Colo., Wash.
5	1	1	2	2	3	4	4	4	3	2	2	2	Del., N. J., Ohio, Ore., Pa.
6	1	1	1	2	3	4	4	5	3	2	2	1	Idaho.
7	1	1	2	2	3	4	5	4	3	2	2	1	Utah.
8	2	2	2	2	3	4	4	4	3	2	2	2	Calif.
9	1	1	2	2	3	4	4	4	4	2	2	2	Md.
10	1	1	1	2	3	4	5	4	4	2	2	1	Neb.
11	1	1	2	2	3	4	4	4	4	3	2	2	Va., W. Va.
12	1	1	2	2	3	4	5	5	4	2	2	1	Nev.
13	2	1	2	2	3	4	5	5	4	3	2	2	Kans., Ky., Mo.
14	2	2	2	3	3	5	5	5	4	3	2	2	N. C., Tenn.
15	2	2	2	3	4	5	5	5	4	3	2	2	Ala., Ariz., Ark., Ga., La., Miss., N. Mex., Okla., S. C., Tex.
16	3	3	3	4	4	5	5	5	4	4	3	3	Fla.

Note: This is a marketing schedule. As a shipping schedule the column headings should read "prior to January 10, February 7, March 10, etc."

TABLE 3—SIMPLIFIED MONTHLY SCHEDULE FOR FIVE SEASONAL GRADES OF MOTOR FUEL

Territory	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
A	1	1	1	2	3	4	4	4	3	2	2	1
B	2	2	2	3	4	5	5	5	4	3	2	2
C	3	3	3	4	4	5	5	5	4	4	3	3

Territory A: North of California, Nevada, Utah, Colorado, Kansas, Missouri, Ohio River and Virginia. Territory B: South of A except C. Territory C: Florida and southernmost part of the United States.

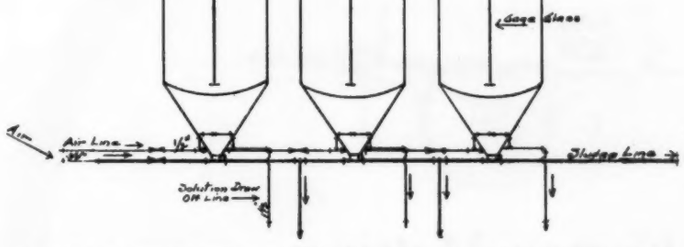
RELATION OF TREATING TO ANTIKNOCK RATING

(Continued from Page 140)

time, no tendency toward the sticking of the valves was developed.

Premium Gasoline

Since this gasoline commands a premium because of the knock rating, it is isolated in tanks so that the sales department is in a position to dispose of it advantageously. And, with proper control of blending the product with the straightrun or crude gasoline produced in the plant, a gasoline meeting standard benzol values is available. The public has come to recognize premium antiknock motor fuels by color as much as by other standards, and the use of oil soluble dyes in this type of gasoline is practiced generally, such as red, orange, blue or green, with the red predominating. In making



In coloring the premium gasoline three 55-gallon agitators are used. The dye and solvent are mixed by a stream of air and the sludge is drawn off to remove inert particles.

up the dye solutions in the plant, small agitators of 55-gallon capacity are used. The dye is placed in the agitator with the solvent, usually benzol, and agitated thoroughly with air, separating the inert particles. The settled sludge is removed at the bottom by forcing out with air. The dye solution is then tested for depth of color and added to the gasoline in the proper quantity.

Dubbs Operation

The Dubbs plant operation is similar in every respect to the conventional Dubbs unit combined with flashing. The cracking furnace is Universal Oil Products design, having been changed, however, from the usual 72-tube unit of upward flow to a 78-tube unit with a partly reversed flow. This change increased the capacity of the unit about 150 bbls. a day, with the advantage of a longer soaking time in the tubes. The reaction chamber, dephlegmators, flash tower and other equipment is standard to the Dubbs unit.

Beyond the dephlegmators is a 6'x40' bubble tower which breaks up the pressure distillate vapors coming from the dephlegmators into gasoline and gas oil. The gasoline vapors leaving the bubble tower run a little over 400° endpoint. From the bubble tower they pass through the clay tower. Superheated steam is used in the bottom of the bubble tower to strip the gas oil of all the gasoline fractions possible. The quantity of steam used depends upon the operation of the clay tower, and consequently the gas oil leaving the bubble tower contains about 15 per cent of heavy gasoline ends. This gas oil is passed through a bubble tray reboiler and the remaining gasoline is removed, giving a final product with a 415° F. to 420° F. initial boiling point. The heavy end gasoline is used back over the bubble tower and dephlegmators for reflux.

The clay tower is 10'x30' and contains 30 tons of clay. The vapors pass downward and the separated polymers drop out the bottom and are refluxed back over the bubble tower. The gasoline vapors leaving the clay tower pass through a knock-out tower and a final bubble tower where, by a small quantity of reflux, an endpoint of close range is maintained on the gasoline, at the same time insuring that the gasoline is polymer free. About 150 gallons per hour of the finished gasoline stream is washed back over the clay tower which prevents the retention of separated polymers in the clay.

Plant Under Pressure

The entire plant is under pressure from the gasoline receiving drum back through the condensers, clay tower and bubble tower. As a result, the fractionating temperature of the bubble tower is considerably higher than is maintained where vapor phase treatment is carried on with low pressure equipment, and consequently the vapors passing through the clay are likewise being acted upon at higher temperatures than is usually customary. The effect appears to be one of marked advantage, both to the quality of the gasoline and the life of the clay.

It is not uncommon in cracking low gravity topped crude to find the maximum life of the clay in low pressure clay towers to be from 1,000 to 2,000 bbls. of gasoline per ton. The life of such clay is usually governed by the color of the stream and the gum content of the gasoline. So far, the operation of the high-pressure clay tower here has reversed the usual experience of low-pressure operation. Instead of a gradual increase in gums and decrease in color, the color has remained consistently around plus 30, while the gum content of the gasoline continues to show a decrease, even with over 5,000 bbls. to the ton of clay. The tower is still operating with the original charge of clay and consequently it is impossible to predict at this time how far it will go before the clay is spent. It is possible that the added vapor temperature of at least 85° to 100° above the usual low pressure operation is sufficiently above the melting point of the polymers to keep them washed out of the clay as soon as they are separated

Successful Resuscitations

With H-H INHALATORS!

Inhalation of petroleum vapors, gas, smoke, carbon monoxide and other poisonous fumes causes oxygen deficiencies in the lungs. The chances of successful resuscitation are greatly enhanced when the H-H INHALATOR is used as an adjunct to the prone pressure method of artificial respiration. Acquaint yourself with this well-known and successfully used safety appliance today.

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"EVERYTHING FOR MINE AND INDUSTRIAL SAFETY"

THE SIGN OF A GOOD HEATER

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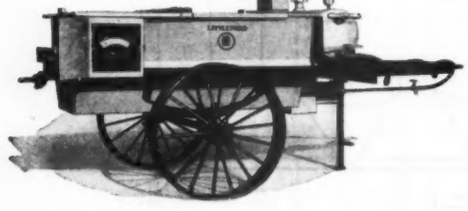
LITTLEFORD BROS. CINCINNATI, OHIO

Two Wheeled "Hot Dope" Kettle, No. 84-HD, capacities: 110, 165 and 210 gallons. Equipped with dial type thermometer.



Faster Melting with Less Fuel . . .

That is what you get from a Littleford "Hot Dope" Kettle—less fuel consumption and faster melting of material. This is accomplished through *even* distribution of heat over the entire kettle—there is no "hot spot" on a Littleford kettle. Overheating, coking and flashing are eliminated. Water proof cover and splash plates prevent splashing. Kettles made in sizes from 110 to 550 gallons.

Write for complete description and prices.

LITTLEFORD BROS.

502 E. Pearl St., Cincinnati, Ohio

LITTLEFORD KETTLES SINCE 1900

from the gasoline, and the life of the clay may be indefinite.

The plant yield from 20-degree gravity topped crude at 915° F. to 920° F. cracking temperature is as follows:

	Per cent
390° endpoint gasoline	41
415° initial zero C.T. gas oil	12
Below 0° gravity residuum	38
Gas	6
Loss	3
	100

The gas oil is marketed for furnace and Diesel oil. The residuum is burned without precooling under the stills and boilers. The gas, after passing through the absorption plant, is also used for refinery fuel. The residuum can be blended back with gas oil for a low cold test fuel oil which remains in mixture in storage for indefinite periods without any settling of asphalts occurring.

It is needless to say that the writers believe that this vapor phase treatment under high pressures with consequent high temperature, introduces a new era in this method of producing a high quality antiknock gasoline, as well as having market advantages from the standpoint of operation.

CORRELATE VAPOR PRESSURE AND LOSSES

(Continued from Page 130)

a tendency for the mixture in the vapor space to contract, resulting in inhaling fresh outside air. However, this is thoroughly intermixed with the vapor-air mixture in the top of the tank almost as rapidly as it is drawn in, by the mechanism outlined above.

The above analysis may be summarized as follows: At the end of a period of reasonable length during which temperature outside the tank is lower than liquid temperature, the gas in the vapor space in the top of the tank tends to become a substantially homogeneous mixture in equilibrium with the liquid, the partial pressure of gasoline in it being equal to that of the vapor pressure of the body of liquid in the tank at tank temperature.

Effect of Temperature Change

It is clear that when outside temperature rises above liquid temperature, the mixture in the vapor space heats and expands, resulting in a breathing loss which, however, other things equal, is proportional to the vapor pressure of the gasoline. This is obviously the mechanism of diurnal breathing, the major cause of evaporation loss in storage. It also applies to those minor factors in storage evaporation, barometric and seasonal temperature variations. In other words, other things equal, storage evaporation losses are proportional to the vapor pressure of the gasoline at storage temperature of the liquid.

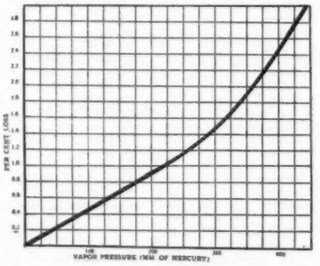


Figure 1—Graph showing variation in loss with average vapor pressure actually existing under distribution conditions considering both temperature variation and extent of weathering.

The substantial uniformity of composition of the gasoline vapor-air mixture in the top of a tank is well illustrated by the following table:

VAPOR SAMPLES TAKEN AT DIFFERENT LEVELS IN STATIONARY GASOLINE TANK

Depth—feet	% O_2
5	8.7
10	8.4
15	8.4
20	8.7
25	8.4

The gasoline content of the mixture was determined by measuring the oxygen content by means of an ordinary Orsat analysis. The air content is clearly proportional to the oxygen content and the gasoline content can, therefore, be obtained by difference.

Losses Due to Pumping

It will be noted that the preceding discussion was limited to storage evaporation, that is, it assumed no change in the volume of liquid in the tank. During pumping and filling operations conditions are radically different. As indicated above, if one pump and fill during a period of high outside temperature, particularly if this temperature be rising, vapor loss is negligible because the air inhaled is exhaled before mixing with vapor occurs to any great extent. Otherwise a series of special cases must be considered.

(a) High outside temperature during pumping, followed by filling under conditions that saturate the expelled air. An illustration is the filling of a tank car through a pipe discharging in the dome under conditions such that the air leaving the car must flow past the stream of liquid discharging from the pump and in intimate contact with it.

The weight loss due to saturation of the inhaled air, entirely aside from any expulsion of it due to incoming liquid, is $MVP^2/RT\ (\pi - P)$.

Where V = the air volume inhaled during pumping and also equals the volume of liquid pumped out.

π = total pressure (barometer).

P = vapor pressure of the gasoline (hydrocarbon pressure).

M = molecular weight of the gasoline vapor (not liquid, but vapor evolved).

R = gas constant.

T = absolute temperature.

ln is calculus symbol for "natural logarithm of")

The total weight loss, due to this plus the expulsion due to replacing the liquid in the tank is $MV\pi P/RT\ (\pi - P)$. This neglects temperature change during the operations.

(b) Standing empty at night after daylight pumping. Due to the convection currents described above, the inhaled air will progressively saturate itself with gasoline vapor. Due to this saturation, the mixture will expand despite the drop in temperature, resulting in an evaporation loss. Granting that the shrinkage due to drop in temperature is negligible in comparison with the expansion due to evaporation, the weight loss due to this cause is

$$W = \frac{MV}{RT}\left(\pi \ln. \frac{\pi}{\pi - P} - P\right)$$

When the tank is filled there will be a further expulsion loss, to be added to the above, of MVP/RT pounds of gasoline.

(c) The air inhaled during pumping saturates itself with gasoline vapor as it enters. This condition could be realized by spraying gasoline into the stream of incoming air. Due to the convection mixing already described, the condition is practically realized when pumping an ordinary tank at moderate rate at night. The evaporation loss in pounds is obviously MVP/RT.

The operating conditions assumed in these three cases are not perfectly realized in practice, but they do represent tendencies which are often closely approached. Study of the equations will make it clear that under the conditions of cases (a) and (b) evaporation losses due to pumping and filling rise with vapor pressure of the gasoline more rapidly than proportional thereto, particularly at high pressures, when the gasoline pressure begins to approach atmospheric. Case (c) gives a loss proportional to vapor pressure. In this it is analogous to storage losses. From this discussion it is clear that in the ordinary handling of gasoline stocks total losses will be proportional to vapor pressure at low gasoline pressures, but will rise more rapidly than this proportionality would indicate as gasoline pressures increase and particularly as they approach atmospheric.

From these considerations which show that any air expelled from a tank for any reason must of necessity be saturated in accordance with the vapor pressure of the liquid at its existing temperature, it follows that evaporation should be in

direct proportion to the existing vapor pressure of the liquid.

Windage Effect

Another cause of loss due to movement of vapor from the tank which is not generally appreciated is the so-called "windage effect" or that due to actual currents of air passing through the tank and leaving saturated with gasoline vapor. Here, too, loss is proportional to vapor pressure. That such loss is potentially serious in tanks which are not vapor tight may be illustrated by the following example:

Assumption

Gasoline tank 120 feet in diameter.	
Vapor pressure of gasoline in the tank at the temperature existing	250 mm.
Assume a crack between the walls and roof of the tank of 0.01" in thickness.	
Temperature	70° F.
Molecular weight of gasoline vapor	84
Net wind velocity	2 mi./hr.
Volume of gasoline in tank	60,000 bbls.

In order to determine the applicability of these principles to evaporation encountered in commercial gasoline distribution, a series of tests were run in which evaporation losses were determined on comparable gasoline shipments having progressively increasing vapor pressures.

	Grade "A" (base stock)	Grade "B"	Grade "C"	Grade "D"	Grade "E"
Abs. vapor pressure mm. Hg. at temp. existing during distribution	204	264	342	412	498
Propane content	0.40%	0.40%	0.44%	0.72%	0.45%
Butane content	2.40%	3.75%	7.62%	4.18%	8.92%
Equivalent butane content	3.91%	5.34%	9.28%	6.89%	10.62%
Gravity	56.7	58.2	60.7	....	....
Engler—I.B.P.	100°	93°	89°	94°	88°
Per cent at 212	25.0	29.5	35.5	28.0	37.0
Per cent at 284	52.0	55.5	60.5	54.5	61.0
Per cent at 392	94.0	96.0	95.5	94.0	93.0
Final boiling point	410°	406°	407°	398°	410°
Per cent recovery	97.5	97.0	96.0	95.5	95.5
Casinghead content	0	8.7	19.8	0	34.7
Loss, per cent	0.869	1.058	1.477	2.054	2.651
Vapor pressure at existing temp. corrected for average extent of weathering	190 mm	235 mm.	300 mm.	365 mm.	425 mm.

These tests were run at and adjacent to the Humble company's Baytown refinery and full data on the various shipments were secured from the refinery to local distribution in Houston 30 miles away. In this work, losses were measured starting with refinery storage, loading and unloading from a barge for water transit to Houston, storage at the local bulk station, and from the bulk station through distribution to local filling stations. In this way, it will be noted that all conditions were met which might possibly be encountered in gasoline distribution; namely: Refinery storage, loading, shipment by water, unloading, bulk sales storage and finally local distribution.

Use Large Scale Operation

In these tests a 60,000-bbl. tank of gasoline was used and its characteristics were carefully noted, namely: Gravity, Engler boiling range, vapor pressure, and analysis for hydrocarbons lighter than pentane. The gasoline gravitated from this tank to a barge at the refinery docks. Gauges, temperatures and samples were taken before, during and after loading. On arrival at the destination of the barge, its contents were pumped into a 10,000-bbl. storage tank, gauges were taken and samples for analysis were secured. Shipments from the shore storage tanks to the city's bulk storage were made in tank cars, accurate gauges, temperatures, and samples again being secured. From the city bulk storage the gasoline was gravitated to tank wagons, barrel fillers and retail filling stations. An accurate account was kept of all such transfers.

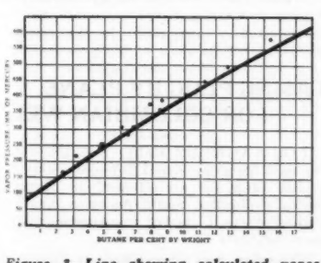


Figure 3—Line showing calculated vapor pressures while points indicate determined vapor pressures.

Practically 10,000 bbls. of the original base stock were distributed through the above system, losses and change in vapor pressure being carefully noted at all stages. With the remainder of this stock, there was then thoroughly incorporated a sufficient amount of grade "A" casinghead gasoline to bring about an increase in absolute vapor pressure of the gasoline of approximately 75 mm. of mercury and the test was repeated, the same information and samples being collected. After four such cycles were completed a range of vapor pressure, at the reference temperature in question of 76° F. of from 200 mm. to 500 mm. had been covered which should include any possible variation in the vapor pressure of commercial gasoline. The characteristics of the different grades involved in the tests are listed in the following table.

The laboratory work in question consisted in determining all current specification characteristics of the different grades involved and in measuring the vapor pressures at various stages during the shipments and analyzing for propane and butane content.

The following results were shown on the laboratory tests:

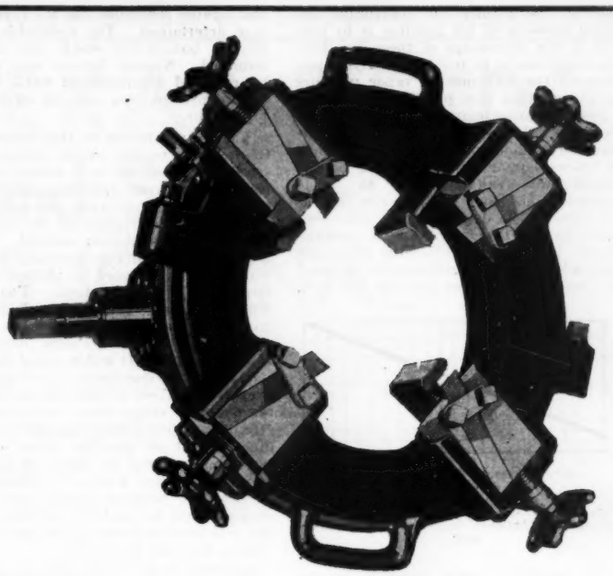
Figure 1 shows the relationship between losses incurred and the vapor pressure existing at the temperature of distribution. At the start of these tests, it was first attempted to correlate the total loss with the initial vapor pressure of the blends measured at the standard reference temperature as they were made up at the refinery but losses plotted against the vapor pressure of the shipment at the same reference temperature showed only a poor correlation. Clearly, however, one should use actual vapor pressure during distribution, which varies with original value occurred because of the weathering during distribution, so that the vapor pressure values shown, besides being corrected for temperature, are corrected to correspond to the average extent of weathering taking place during the distribution of each grade. It will be noted from Figure 1 that when the original vapor pressures are thus corrected, satisfactory correlation is obtained.

The curve derived in this way does not, as would be expected from the above consideration of the mechanism of evaporation, show a relationship exactly linear between vapor pressure and evaporation loss, the actually determined losses, in fact, increasing more rapidly than proportionally to vapor pressure.

From the curve, it is apparent that, for all practical purposes, over a vapor range up to 300 mm. which includes a large proportion of the motor gasolines being marketed today, loss is substantially a linear function of vapor pressure. Where appreciable changes in molecular weight of the vapor occur, loss is of course proportional to this factor also. The simplicity of this relationship is fortunate since, if, for a gasoline of known vapor pressure, losses over a fixed set of distribution conditions are known, then the change in such losses corresponding to any desired contemplated change in vapor pressure may be predicted. Above 300 mm. the increase in loss with vapor pressure is greater. However, if the same data be plotted on semilogarithmic paper, as shown in Figure 2, a straight line results from which loss may be predicted for even higher values of vapor pressure than 300 mm.

Effect of Constituents

The vapor pressure of gasoline is due almost entirely to its content of low boiling hydrocarbons. The only method avail-



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able to the refiner for controlling the vapor pressure of his gasoline is by control of the percentage of these low boiling constituents in it. The analysis just given of the influence of vapor pressure on evaporation loss puts the refiner in a position to estimate quantitatively the economic value of vapor pressure. However, he cannot solve his problem until he knows how much of the low boiling constituents available must be incorporated in his gasoline to give it the vapor pressure he desires. It is now generally agreed that all available pentane should be incorporated into the gasoline, whether from refinery or natural gas sources, and that propane, because

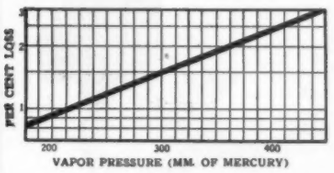


Figure 2—Graph showing semilogarithmic relationship between loss and vapor pressure.

of its excessive vapor pressure, is an undesirable constituent. Obviously, therefore, the question reduces itself to this: How much butane, intermediate between these two, together with its isomers and homologue, should be incorporated in the gasoline in order to give it a given vapor pressure?

Previous work on other hydrocarbons[5] has shown that Raoult's law can be used with a fair degree of accuracy to calculate the effect upon the vapor pressure of the various constituents in hydrocarbon mixtures, particularly mixtures containing butane. However, no data are available on the effect of butane in normal gasolines. There is no sound reason to doubt that here, too, Raoult's law will hold, but the economic importance of the problem is far too great to justify accepting this conclusion on assumption or hearsay, in the absence of direct experimental proof. Therefore, in order to determine specificially whether Raoult's law can be used to correlate butane content and gasoline vapor pressure over the range of refinery variations, a sample of gasoline was stripped completely of butane and lighter fractions and its vapor pressure determined. The molecular weight of this butane-free stock was also determined. Normal butane was purified by repeated fractionation until the isobutane present was reduced to not over 1 per cent.

Varying quantities of this butane were then added to the above stripped base stock to correspond to a range in vapor pressure of from approximately 100 to 600 mm. and the vapor pressure of all these blends determined by the above described air equilibrium method. Figure 3 shows the results in graphical form, in which vapor pressure is plotted against measured butane content. The curve drawn represents the values calculated by means of Raoult's law and the points correspond to the actually determined vapor pressures. It will be noted that a remarkably close correlation is afforded, the average deviation of the calculated from the observed values being not over 3 per cent. In other words, the effect of butane content on gasoline vapor pressure can be calculated by Raoult's law. It is apparent that Curve 1, showing the relationship between losses and vapor pressure, can be used to establish a similar relationship between loss and butane content for this base stock.

However, it is not possible to plot the above data with losses and butane content as the two variables because of the variation in temperature which existed for the various shipments. While this may be taken into account by correcting for the known variation in vapor pressure with temperature, if butane content is substituted for vapor pressure, it is not possible directly to make allowance for temperature correction. For any set of gasoline distribution conditions, however, with fixed temperature conditions the variation of loss with butane content may be readily evaluated from the above relationship.

Using Raoult's law and knowing the vapor pressures and molecular weights of pure butane and propane, the percentages of propane contained in the above table, showing the characteristics of the different grades distributed, have been converted over to the corresponding percentages of butane for the same vapor pressure. The increase in such "equivalent" butane content corresponding to the increase in vapor pressure shown of 300 mm. is approximately 8 per cent where the corresponding losses show only a change of from 0.8 per cent to 2.4 per cent or a net increase of 1.6 per cent. Thus, no more than one-fifth of the butane added over normal conditions was lost, so that the economic balance for these particular storage and distribution conditions is apparently in favor of the incorporation of additional butane. It should be borne in mind that similar examination must be made in each case, since, for a more severe set of evaporation conditions, the conclusion might be reversed.

[5]L. B. Hitchcock and G. Calingaert, Journal American Chemical Society, 1927, page 765.

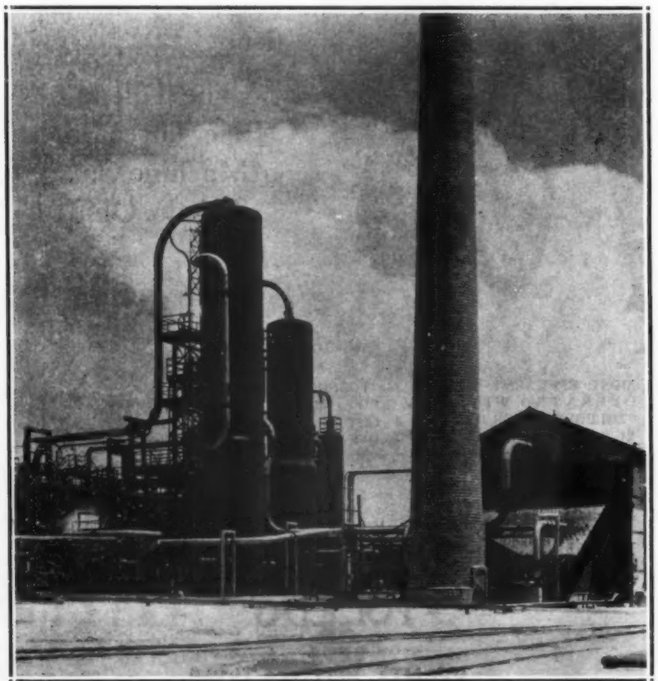
General Relationship Exists

With, however, a general relationship available between loss and vapor pressure, examination need only be carried through the determination of losses incidental to one vapor pressure condition, from which results the losses for other vapor pressure conditions may be calculated. In other words, while it is realized that the actual curve secured above is only applicable to the particular refinery and distribution conditions in question, nevertheless, it is believed that the general relationship indicated over the practical operating range holds for any conditions.

For the particular refinery in question, the specific results secured were of considerable value in determining just what measures were justified in increasing butane recoveries from the fuel gas line. However, with this general relationship available between losses and vapor pressures, it is possible in the case of any refinery situation, knowing the existing vapor pressure and the corresponding extent of evaporation loss, to calculate the maximum economic per cent of butane recovery as determined by the existing differential in its value as gasoline or fuel gas.

In general, increase in butane content up to the economic point usually makes for increase in quality of the gasoline produced, since easy starting is thereby improved. On the other hand, the limitation must be kept in mind that the gasoline must not be made so volatile as to incur any danger of "vapor locking."

The same principle may also be used in other phases of petroleum work to calculate the extent to which manipulators of crude and finished products and pipe line storage are justified in going in taking preventive measures against evaporation loss. In other words, knowing the evaporation loss for the handling of a given product of a known vapor pressure, if this vapor pressure is to be increased for any reason, as, for example, by change of temperature with approaching summer or change in the nature of the product, then the increased evaporation losses due to the anticipated increase in vapor pressure may be evaluated and the economic equivalent of this loss be balanced against the expense of the necessary equipment to minimize it.



New 20,000-bbl. Badger topping unit at the Baytown plant of Humble Oil & Refining Co.

COMBATING CORROSION WITH USE OF AMMONIA

(Continued from Page 139)

bubble tower; second, in the vapor line between the bubble tower outlet and the first heat exchanger. The former is undoubtedly the better place in this instance since some corrosion was taking place in the region of the heat exchanger in the top of the tower.

The quantity of ammonia to be fed will depend upon the corrosive quality of the crude and the most practical way to determine this quantity is to test the water coming overhead with the streams at the receiving house. The ideal condition of this water is neutrality but it can be maintained very slightly alkaline, and this condition may be readily detected with a drop or two of phenolphthalein or an even more delicate indicator known as Cresol Red. When the condition is found to be right at the receiving house the flow meter should be read in pounds of ammonia flowing per 24 hours, and the control valve can then be set to maintain this rate of flow. It is worth noting here that the formation of ice on the outside of the cylinder is due to too rapid withdrawal of ammonia. If the rate of flow does not exceed 25 pounds per day, ice formation will be avoided. Should a greater quantity be required two or more cylinders may be manifolded together. On account of the rapid rise of vapor pressure of ammonia at higher temperatures, cylinders should never be heated by steam or other means to remove ice from the outside.

One of the largest refineries in the eastern United States by applying anhydrous ammonia at several points in their equipment has reduced corrosion by 97 per cent.

A convincing demonstration to show whether or not corrosion is actually going on may be made by running a simple qualitative test for dissolved iron in the water which comes over with the gasoline and kerosene streams. This test is made at the receiving house by taking a sample of one of the gasoline or kerosene streams from the look-box, separating the water layer and treating it with a few drops of potassium ferro-cyanide. If iron is present in the water a blue color will appear. Having shown that iron is being lost through corrosion, the next thing is to determine how rapidly the equipment is being eaten away—in other words, how many pounds of iron are being lost per 24 hours. By making a quantitative determination of the amount of dissolved iron in the sample of water from a given stream, and knowing the quantity of water coming over per day, the number of pounds of iron being lost may be readily calculated.

Handling of Ammonia

With the increasing use of ammonia for corrosion prevention, and the expectation of still more widespread refining of sour crudes, some of the largest refiners are considering the economic advantage of purchasing anhydrous ammonia in tank cars. These tank cars, which contain 50,000 pounds of ammonia, are tested to withstand an internal pressure of 500 pounds per square inch, and are provided with safety valves to pop off at 200 pounds per square inch gauge pressure.

Anhydrous ammonia which is a pure gas (NH_3) is liquefied by pressure and cooling, and in the tank car it exists as a liquid which at the time of shipment exerts a pressure of about 40 pounds per square inch. The pressure exerted by liquefied anhydrous ammonia is dependent upon the temperature of the liquid. The dome of the anhydrous tank car is provided with four inlet pipes with valves. Two of these pipes extend to a small sump at the bottom of the tank car and two extend to about 18 inches below the dome. These short pipes do not reach the liquid.

Users of tank car quantities of ammonia may store it in either of two ways:

1. The anhydrous ammonia may be taken off as liquid, passed into a tank partly filled with water, and thus stored as aqua-ammonia of desired strength.

2. High pressure storage tanks may receive the liquid anhydrous ammonia under pressure and store it in that form.

Under these conditions, by means of a piping system, gaseous ammonia can be distributed to any point in the refinery by virtue of its own vapor pressure.

CASING PLUG BY PLANE FOR COLOMBIAN WELL

LOS ANGELES, Calif., Feb. 28.—Riding as a passenger, a 175-pound cast-iron casing plug for an oil well in Barranquilla, Colombia, South America, has left United Airport aboard an American Airways skyliner.

The plug was dispatched at full passenger fare—$550, plus duties of $250, for the 4,000-mile hop.

It was found necessary to rush the plug southward by air because operation of the Colombian well cannot proceed without one. The Standard Oil Co. of California found it would take a month to get the plug to South America by water, so made the unique arrangement with American Airways for its transfer.

Under airline schedule the "passenger" will arrive in Barranquilla six days after leaving here. It will fly over part of the United States, Mexico, Guatemala, Salvador, Honduras, Nicaragua, Porto Rico and Panama en route to Colombia.

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By: A. C. Saleh

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313 R

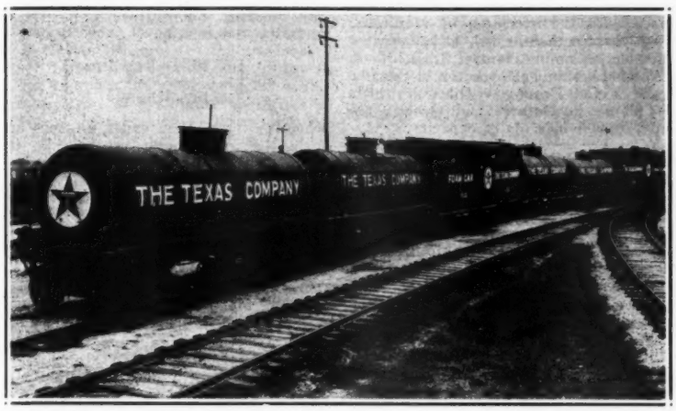
REDUCING FIRE LOSES AT OIL REFINERIES

(Continued from Page 150)

trained men must have proper and adequate equipment for their use. The present day offers a variety of well developed equipment and chemicals for combating fires. The use of small extinguishers, steam hose, etc., generously and advantageously located on operating equipment affords the operator a means of extinguishing small flashes or to hold in check larger fires until portable or permanent equipment can be brought into use.

The policy of locating fire fighting equipment such as hose, hydrants, extinguishers, etc., about a fire area has many advantages. Operating personnel, outside of the regular fire companies, should not only be familiar with its location but also its use. In larger plants, stationary equipment scattered about the plant should be augmented by portable equipment for general use. Portable equipment can vary from a small trailer or hose cart up to and including railway car capacities. The photograph showing the train of six cars has a capacity of 18,500 gallons of each solution used for foam production and pumping equipment of 815 gallons per minute. The power is supplied by a stream from the locomotive used in transportation.

With all modern devices for fire protection, the best investment will be that spent in perfecting equipment for fire prevention. Since this ultimate goal has not been attained as yet, it is necessary to prevent spreading of fire by methods of restriction and segregation. This affords a ready and efficient means of combating fires with trained organizations and modern, well maintained equipment.



Foam train including four tank cars, a pump car and a hose car. This equipment is capable of delivering 37,000 gallons of solution at a rate of 815 gallons per minute. Steam is supplied to the pump by the locomotive used to haul the train to the fire site.

RECORD NUMBER OF OPERATING REFINERIES

(Continued from Page 103)

connection with the daily cracking capacity at the plants, New Jersey is seen to follow California close third with 183,037 bbls. as its figure. Although there are only nine refineries in New Jersey these have a total daily capacity of 313,000 bbls., giving an average for each refinery of 34,778 bbls. daily. Eight of the refineries are equipped for producing gasoline from the residual oils, one of them, Standard Oil Co. of New Jersey, having cracking installations at Linden with a daily capacity of 113,837 bbls.

The past year has seen considerable reorganization and relocation of plants among refiners in Michigan. In 1929 and 1930, four small plants were built in and near Muskegon as a result of the bringing in of substantial production in that area. However, the production quickly declined and it soon became apparent that there would not be sufficient crude oil to supply the local refiners and the outside state demand consisting principally of the Standard Oil Co. of Indiana which through a subsidiary company has been buying oil and shipping to its Whiting, Ind., refinery.

The crude oil situation has been relieved somewhat through the development in the Mount Pleasant area of Michigan. The Michigan Central Refining Co. was reorganized under the name of the Roosevelt Oil Co. and the plant previously operated at Muskegon was removed to Mount Pleasant.

At Muskegon, the Naph-Sol Refining Co. was organized and took over the plant formerly owned by the Muskegon Refineries, Inc. This plant was built in 1929 but was never operated until taken over by its present owners. Several changes were made in the organization of the Old Dutch Refining Co. and the plant at Muskegon enlarged. Both the Naph-Sol and Old Dutch refineries are largely devoted to the manufacture of special naphthas. The Old Dutch plant obtains part of its crude supply from the Muskegon Field.

The Standard Oil Co. of Indiana refinery at Zilwaukee, Mich., the first plant to be built in the State, was shut down during the past year. The crude oil supply in that area had decreased to the point where refinery operations were not justified. Some additions, both in crude oil and cracking capacities, were made at the Trenton (near Detroit) refinery of the White Star Refining Co.

The Mount Pleasant Field may bring further refining activities in the State as development proceeds. However, Pure Oil Co. has large holdings in the area and is taking oil from the field to supply the refinery they have recently completed at Toledo, Ohio. The oil is moved by pipe line to the Great Lakes navigation system and during the navigation season is transported by boat to Toledo.

Hydrogenation

A new phase of refining operation is reflected for the first time during the period covered in the survey. This is in connection with the progress of work in developing hydrogenation in the United States. More than a score of the larger refinery operators have been announced as prospective licensees of the company organized to handle rights to use of the hydrogenation process for the Standard Oil Co. of New Jersey and the I. G. Farbenindustrie of Germany, in the United States and Canada.

Standard Oil Co. of New Jersey is operating a 5,000-bbl. hydrogenation plant at Bayway, N. J., while Standard Oil Co. of Louisiana, a subsidiary of the New Jersey company, is completing a hydrogenation plant of the same capacity at Baton Rouge, La. Humble Oil & Refining Co., another subsidiary of the Standard of New Jersey, is to build a similar plant at Baytown, Tex.

Imperial Oil, Ltd., representatives of the Standard Oil Co. of New Jersey in Canada, have announced plans to construct a hydrogenation plant at one of its Canadian refineries.

The Oil and Gas Journal's survey of operating refineries in Canada is the first of its kind to be completed. Data which

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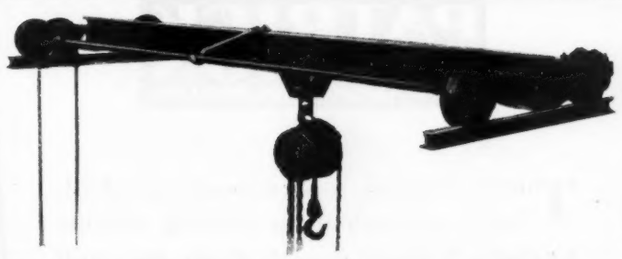

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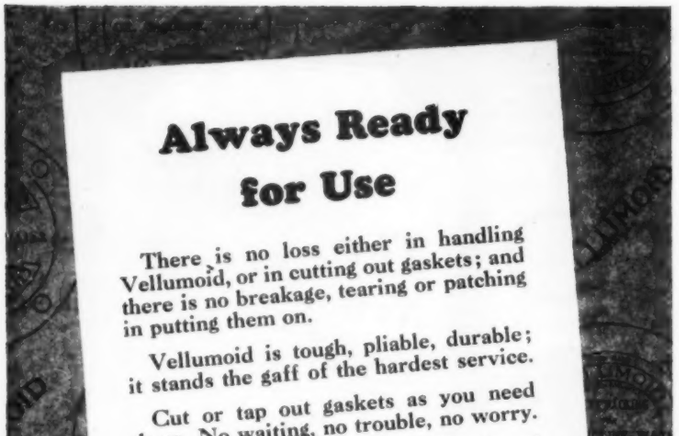
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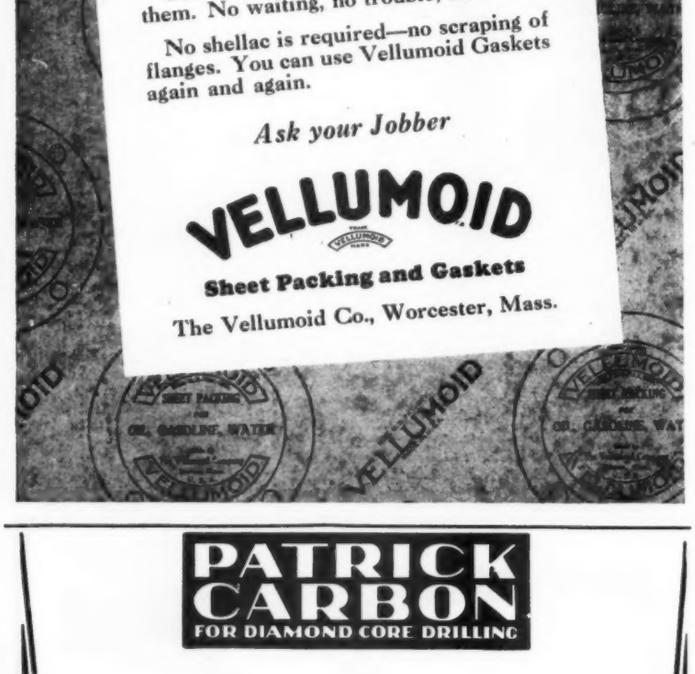
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have been released by government bureaus in this connection have been concerned only with the location of the various plants and their daily crude capacity.

Reviewing the refineries in the provinces, the total daily capacity of their plants is seen to be as follows:

Alberta, with four plants, 13,500 bbls. capacity; British Columbia, with three plants, 21,000 bbls. capacity; Manitoba, with one plant, 300 bbls. capacity; Nova Scotia, with one plant, 17,000 bbls. capacity; Ontario, with four plants, 38,500 bbls. capacity; Quebec, with two plants, 38,000 bbls. capacity; Saskatchewan, with one plant, 7,200 bbls. capacity. These give Canada a total daily capacity of 135,500 bbls. for its 15 refineries.

Imperial Oil Co., Ltd., representative in Canada of the Standard Oil Co. of New Jersey, is the largest refinery operator in the Dominion. This company has six refineries with a total daily capacity of 97,200 bbls. Its plants are located in all of the provinces above mentioned with the exception of Manitoba, where the North Star Oil, Ltd., operates a 300-bbl. skimming plant at St. Boniface.

Another prominent operator in Canada is the McColl-Frontenac Oil Co., which has plants in Ontario and Quebec, totaling 18,000 bbls. daily capacity.

FUEL RESEARCH AT BUREAU OF STANDARDS

(Continued from Page 143)

from vapor lock, is vapor pressure. In connection with vapor lock in automobiles, the main factor is the temperature at which the vapor pressure becomes equal to atmospheric pressure. With airplanes, however, the altitude must be taken into consideration for the boiling point changes with pressure. The three fundamental variables in connection with vapor lock, therefore, are vapor pressure, temperature and pressure.

While several commercial methods for the measurement of vapor pressure were available at the inception of this work, there was no evidence that any of them measured that vapor pressure which was significant as regards vapor lock. Accordingly an apparatus and method[8] were developed for the measurement of the true vapor pressures of gasolines and for the study of the three variables mentioned. Since gasolines contain dissolved gases and water in solution, determinations were made of the solubility of air, ethane, propane and water in a number of gasolines. With the exception of propane, it was concluded that the others were not present in commercial samples in sufficient quantity to cause trouble from vapor lock. Therefore a method was developed for removing these substances, leaving the propane and higher hydrocarbons in the sample in the same proportions as in the original gasoline. Vapor pressure data over a considerable temperature range were obtained on 43 diverse gasolines and blends, after treatment to remove water and dissolved gases. It was found that one vapor pressure measurement in conjunction with the A.S.T.M. 10 per cent point and the slope of the A.S.T.M. curve at this point, was adequate to reproduce the boiling points at any desired altitude with an accuracy of 1° F.

Since the apparatus and the method for the determination of the gas-free vapor pressures were very complicated, the next step was the development of a practical test for vapor pressure. Three such tests were found, which are as follows:

1. The Reid vapor pressure values at 100° F., when multiplied by the factor 1.1 were shown to equal the gas-free vapor pressures at the same temperature. Accordingly the Reid method serves as a general practical test for the vapor pressure of interest.

2. The A.S.T.M. 10 per cent point was shown to be equal within 2° F. to the temperature at which the gas-free vapor pressure was atmospheric (14.7 lb./in.²) in the case of gasolines free from propane.

3. The initial liquid boiling point, as determined by a thermometer in the liquid during the A.S.T.M. distillation test, was found to equal the temperature at which the gas-free vapor pressure was atmospheric. This test is only approximate due to the difficulty of measuring accurately the initial liquid boiling point.

It next remained to be shown that the Reid vapor pressure, or the A.S.T.M. 10 per cent point in the case of propane-free gasolines, was a significant test as regards vapor lock in fuel feed systems. For this purpose, various typical airplane and automobile fuel feed systems, and parts of such systems, were set up and vapor lock experiments made in them with a variety of fuels.[9] It was found that the Reid vapor pressure test was significant not only as regards vapor lock in automobiles but also in airplanes at any desired altitude. The A.S.T.M. 10 per cent point was likewise satisfactory for propane-free fuels. If the Reid method at 100° F. is employed for measuring the vapor pressure, then the vapor-locking temperature t in °F. is given by the relation

$$t = 560 \left[\frac{5.167 - \log 1.1\, p_R}{5.167 - \log p} \right] - 458$$

where p_R is the Reid vapor pressure and p is the atmospheric pressure at the given altitude, both in lb./in.²

In order that vapor lock may occur, it is necessary that the fuel boil in the fuel feed system, so that the amount of heat from the engine and the design of the fuel system have an important effect on vapor lock. In gravity feed systems, vapor lock usually occurs between the tank and the carburetor. In vacuum tank systems, it usually takes place between the vacuum tank outlet and the carburetor. In fuel pump systems, the flow is interrupted on the suction side of the pump. In rare cases, vapor lock will occur in the carburetor jets. In order to ascertain what temperatures actually exist in fuel feed systems, measurements have been made in a variety of automobiles, buses and airplanes under operating conditions.[10] Based on values obtained in 27 automobiles, the average temperature of the gasoline by the time it reached the carburetor was 41° F. above that of the atmosphere. If vapor lock is to be avoided when driving in the average car on the road at 40 miles per hour with an atmospheric temperature of 90° F., the gasoline must have a Reid vapor pressure of less than 9.5 lb./in. During idling after such a run, the maximum vapor pressure for protection is 6.5 lb./in². If 80 per cent of the cars on the road are to be protected from vapor lock troubles, the corresponding vapor pressures at 40 miles per hour and on idling after such a run are 7 and 5.5 lb./in. respectively.

The fuel line temperatures observed in eight buses under normal operating conditions were somewhat lower. The results obtained in this temperature survey indicated very definitely that design of the fuel feed system played a very important part in the fuel temperatures attained and hence in the tendency to cause vapor lock troubles. The car manufacturers are aware of this fact and improvements have been made in many current models. It is proposed to conduct a similar survey on 1931 cars during the coming summer.

Temperature measurements in airplanes indicate likewise that fuel line design has a marked effect on the temperature attained by the fuel. The situation is somewhat different in airplanes than in cars, for the air temperatures at various altitudes are essentially independent of ground temperature. It has been concluded that the temperature of the fuel in the tank at the time the airplane leaves the ground is the main factor in airplane vapor lock, if the vapor pressure of the fuel is not abnormally high.

From the fuel standpoint, one general fact has been deduced from the above work. It is considered that propane in the gasoline is the worst offender as regards vapor lock and precautions should

[8] S.A.E. Journal, May, 1929, Page 488; July, 1930, Page 93; A.P.I. bulletin, January 2, 1930, Section 3, Page 4.

[9] S.A.E. Journal, August, 1930, Page 218; October, 1930, Page 444.

[10] S.A.E. Journal, March, 1931 (in press).

be taken to remove it, particularly in aviation fuels, if vapor lock trouble is to be minimized. A propane content of 1 per cent, which is not unusual, will increase the Reid vapor pressure approximately 2.2 lb./in².

Gum Content

The gum content of a gasoline is a property which has only recently become of widespread importance, as a result largely of the attempt to increase the antiknock value by more intensive cracking. When a gasoline containing gum is used in the engine, the gum is left behind as a deposit on the walls of the manifold and on the intake valves when the gasoline evaporates. Since gum deposition is an evaporation phenomenon, this suggests that an evaporation test would serve to give the desired information regarding the gumming characteristics of gasoline.

Several methods have been proposed for the measurement of the gum content by evaporation. Extensive comparisons[11] on a variety of gasolines indicated that these methods gave radically different values and that different methods would rate a series of gasolines in different orders. A complication is introduced by the fact that the gasoline may contain gum-forming materials which during the evaporation test may be transformed to gum and remain as residue. A preliminary analysis of the information obtained in the comparison between different methods has suggested that the variables involved in the evaporation test are time of evaporation, temperature of evaporation, atmosphere in contact with the gasoline during evaporation, and catalytic effects by the material composing the evaporation dish. On the basis of this preliminary analysis, an investigation is being made of these variables to ascertain whether they are the significant variables involved in gum deposition in the engine. The establishment of this will probably also lead to sufficient information regarding their effects on gum deposition and to a precise method of test for gum content. This work is at present under way and when completed, the succeeding steps in the investigation will be the development of a practical test for gum content, and the evaluation of the relation between the gum content and the amount deposited in the engine.

The above investigation is limited to the gum content of the gasoline at the time of use. However, many gasolines will form gum on storage, which is a phase of the problem independent of the one outlined. Work is being done on this phase but is hampered by the fact that it is not feasible to determine the increase in gum content of a gasoline until an adequate method is available for determining the gum content at any one time.

Sulphur Content

Information to date on sulphur in gasoline has indicated that there are two problems, corrosion in the fuel feed system and corrosion in the crankcase. Since the former occurs before the fuel is burned, this type of corrosion is due to sulphur compounds present in corrosive form in the gasoline. In the case of corrosion in the crankcase, the total sulphur content appears to be of major interest. The generally accepted limit for total sulphur is 0.10 per cent which is based on a very limited amount of information. While this limit appears to be safe, there is a possibility that it can be increased under certain conditions such as warm climates. Plans are under way for an investigation of sulphur by the Bureau of Standards and when this is commenced, the same general procedure will be followed in the investigation as that outlined in connection with the preceding problems in the hope of arriving at a general answer, of a fundamental nature.

Antiknock Value

The problem of detonation is a difficult one and involves many engine variables. It is not known precisely what detonation is nor are the fundamental variables affecting it established as yet.

[11]S.A.E. Journal, February, 1931, Page 191.

Intensive work[12] on the effect of the engine variables is being done by the Bureau of Standards and by the co-operating laboratories comprising the detonation subcommittee of the Co-operative Fuel Research Steering Committee. The urgency of the problem has necessitated the development of a test engine and procedure based on the engine variables and very satisfactory progress has been made along these lines. The adoption of octane numbers and a standard primary reference scale has gone far to clear up discrepancies between various laboratories in rating fuels.

It is anticipated that the work on a tentative standard engine and procedure and on the engine variables will throw much light on the determination of what are the fundamental variables from the fuel standpoint. Charge temperature, compression pressure and air-fuel ratio are probably among these fundamental variables. When the important characteristics of a fuel as regards detonation are once evaluated, this will form a basis for a more fundamental investigation of the problem and will conceivably lead to simpler laboratory methods of test. Work along these lines is contemplated.

Conclusions

In conclusion, it may be said that it is the aim of the bureau to provide answers to the various fuel problems which are on the one hand practical and on the other hand sufficiently general to be applicable to the entire petroleum and automotive industries. It is felt that important problems of this nature should be attacked from a fundamental standpoint in the hope that the information thus obtained will form a background for the improvement of both fuels and engines and for the mutual adaptation of one to the other.

[12]S. A. E. Journal, July, 1930, Page 56; A.P.I. bulletin, December 31, 1930, Section 3, Page 38.

MOLECULAR STRUCTURE AND KNOCK RATING

(Continued from Page 147)

1, which is much below that of conventional engines in use today. Such an engine would naturally be very low in power and in efficiency. But, if it could be run on a fuel composed of the most closely centralized heptane referred to, an automobile engine could then have a compression ratio four times as high, or 12 to 1. This is a much higher compression than has ever been used in automobile engines. It is so high, in fact, as to come within the range used in Diesel or compression-ignition engines. Thus it appears that the gasoline engine likes the best of the heptanes better than alcohol, strange as that may seem. In other words, the best of the various heptanes can be run at higher compressions than can ethyl alcohol. That is indeed a very remarkable thing.

The matter presented above suggests that Pennsylvania gasolines are not composed to a large extent of straight chain paraffin hydrocarbons; for, if they were, the gasolines would knock much worse than they actually do. The above matter shows also that if Pennsylvania gasolines could consist altogether of paraffin hydrocarbons of the better types of structure from the viewpoint of knock they would then have antiknock qualities much higher than those of the best gasolines sold today, whatever their source.

D. E. HENDERSON DIES

WAYNE, Ohio, Mar. 2.—David E. Henderson, 61, retired oil operator, was found dead in his bed by his daughter, Mrs. Dean Sage, Toledo, when she entered the home to pay her father a surprise visit. His death was due to apoplexy. Mr. Henderson had lived in Wayne, better known as Prairie Depot, more than 35 years, being one of the pioneers in the days of the "oil boom" when old Montgomery Township, Wood County, had many strings of tools working on all sides of Prairie Depot.

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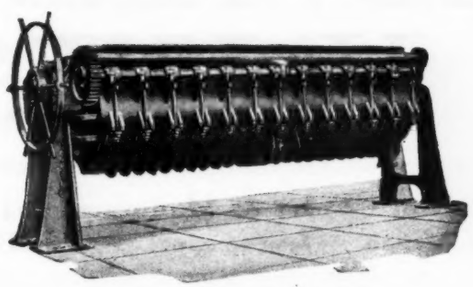

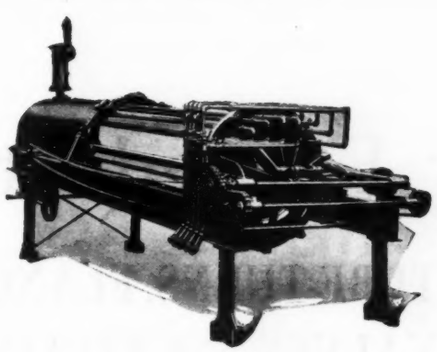

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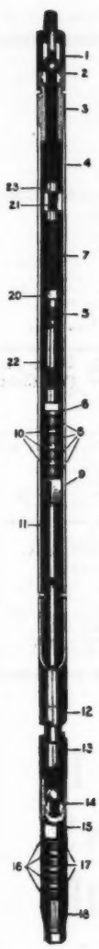

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NEW DEVELOPMENTS IN KNOCK RATING

(Continued from Page 101)

knock itself, but such influence is usually not large. Absolute agreement in octane number ratings cannot be expected until standardized methods of measurement are universally agreed upon, but in most cases, apparently, octane numbers obtained for a given fuel by almost any well recognized method of measurement will agree reasonably well. The subcommittee on detonation has made much progress[3] in developing standard methods of test, and recommendations on this subject may be expected in the not too distant future.

The most direct method of determining the octane number of a fuel is to compare the fuel under specified engine conditions with blends of heptane and iso-octane of different concentrations until a blend is found which is equal in knocking tendency to the fuel in question. The percentage of iso-octane in this blend is the octane number of the fuel. It goes without saying that the engine conditions, such as speed, temperature, etc., should be rigidly fixed, and that the air-fuel ratio of both fuels should be that for maximum knock.

Unfortunately nearly all chemically pure hydrocarbons are very expensive, and this is true of heptane and octane. It is, therefore, desirable, for routine testing, to make use of secondary standards which have been calibrated by direct comparison with heptane and octane.

Secondary Standards

Any laboratory may prepare secondary standards for its own use by setting aside one or more suitable stable gasolines of appropriate antiknock value and determining on the engine the octane number of these gasolines, and blends of them with each other, or blends of them with benzene, tetraethyl lead, or some similar substance. In this way a scale may be determined permitting the indirect determination of octane numbers by comparing unknown fuels with the secondary standards and then reporting the octane numbers from the previous calibration data.

It is highly desirable, however, that all laboratories should, as far as possible, use the same secondary standards, and much work is in progress looking toward the segregation of large quantities of stable gasolines which may be made available to the industry at large as secondary standards. The first of such standards to become generally available are two gasolines recently segregated by the Standard Oil Development Co.[4] Over 30,000 gallons of these two gasolines have been set aside, and may be purchased for knock testing work at moderate cost by anyone interested. These two gasolines have octane numbers of about 50 and 68 respectively, and blends of them with each other and with tetraethyl lead and benzene have been calibrated against heptane and octane on a particular engine. Of course, any laboratory may repeat such calibration by its own technique. It is probable that other secondary standards of general availability will shortly appear.

The curves in Figures 1, 2, 3, and 4[5] show the octane number ratings of these secondary standards and their various blends, and illustrate well the use of secondary standards in making knock ratings in terms of octane numbers.

[3]Boyd, "Progress Toward a Uniform Method of Measuring Detonation," Proc. Eleventh Annual Meeting, American Petroleum Institute.

[4]Further information concerning these two fuels may be obtained from Ross H. Dickson, Standard Oil Development Co., 26 Broadway, New York City.

[5]The writer is indebted to the Standard Oil Development Co. for permission to use these data, which were obtained on an Ethyl "Series 30" engine, at 212° jacket temperature, at 600 r.p.m, using the bouncing pin technique.

J. J. GARRETSON DIES

DALLAS, Tex., Feb. 28.—J. J. Garretson, oil man and resident of Dallas for eight years, died at a local hospital Saturday night.

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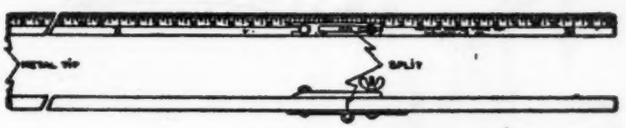

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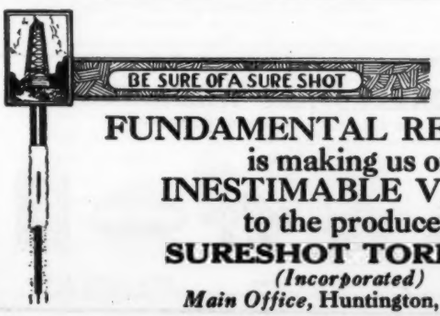

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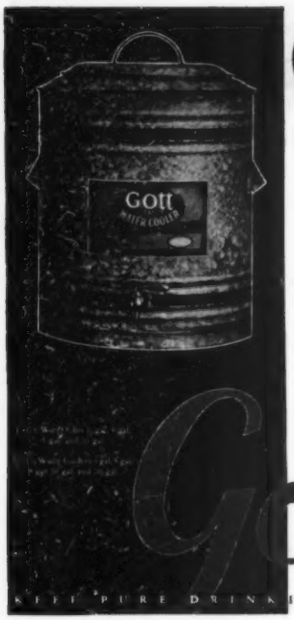

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(Continued from Page 141)

the unstable, gum forming, constituents.

A similar, less comprehensive, series of treats were made using 60° acid maintaining all other conditions constant. The results of these treats are given in Table 2.

As would be expected, the loss produced by 60° acid is less than when using 66°. In these treats the loss was reduced about one-quarter. The ratio between the sludge loss and polymer loss was slightly lower than when using 66° acid, indicating a decreased tendency towards polymerization. This fact is also evidenced by the comparison between the boiling ranges of the finished gasolines and the gravities of the residua. As long as the amount of acid used is 5 pounds per barrel, or less, the chief advantage produced by using 60°, instead of 66°, is the reduction in treating loss. As the quantity of acid exceeds 5 pounds per barrel there is a decided reduction in the loss of antiknock value, due to the use of the more dilute acid. It was realized that the treating temperature also has a decided effect upon the allowable concentration of acid to be used for a given purpose. However, it is felt that the use of a dilute acid (60-62° Be.) at normal atmospheric temperature is more economical than the use of 66° acid at a temperature below atmospheric.

Effect of Agitation

The effect of the time of agitation was also investigated by making a series of 5-pound treats using both 60° and 66° acid. The results of these treats are shown in Table 3.

The effect of the time of contacting is more pronounced with regard to the losses than to the quality of the treated product. Increasing the time of contacting with 66° acid, from 2 to 30 minutes almost triples the sludge and polymerization losses. An equal increase when using 60° acid doubles the sludge loss and raises the polymer loss slightly. The effect on the quality of the product is so slight as to be negligible. Apparently no desirable change is produced by increasing the time of contacting beyond five minutes. The effect of time of contacting would undoubtedly be greatly increased if more than 5 pounds of acid per barrel were used.

The stock used in making these treats when tested for unsaturation by the method of Egloff and Morrell* indicated an unsaturated content of 33.2 per cent. The treated gasoline remaining after the removal of the so-called unsaturated hydrocarbons had an antiknock value 3.2 cc. tetraethyl lead lower than the original charge. This corresponds to a reduction of approximately 25 per cent in benzol equivalent. On this basis the material removed must have had an equivalent of 75 per cent benzol, which is unusually high for unsaturated hydrocarbons. It, therefore, seems likely, that if the aromatic and naphthene hydrocarbons are unaffected by cold 80 per cent sulphuric acid, that a large portion of them must go into solution in the sludge, for the reduction in antiknock is far greater than the removal of the unsaturated hydrocarbons would lead one to expect.

Under conditions where the problem of desulphurization is not the controlling factor, it seems logical to assume that the least quantity of the most dilute acid that will give the desired degree of refining should be used. Such a treating reagent should give the minimum treating loss both as regards volume and antiknock. These two losses are always the major items of expense in any treating operation.

*Industrial and Engineering Chemistry, 18:354, 1926.

NEW OFFICERS NAMED

CHATHAM, Ontario, Feb. 28.—Formal announcement has been made by Alberta Pacific Consolidated Oils, Ltd. of the appointment of George W. Scott, well known in United States fields, to the position of general manager of the company. S. B. Phipps, formerly with the Alberta Pacific Grain Co., has been named secretary-treasurer.

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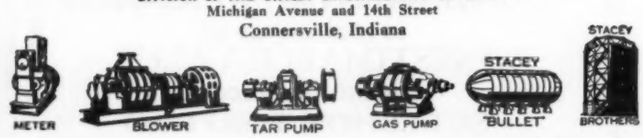

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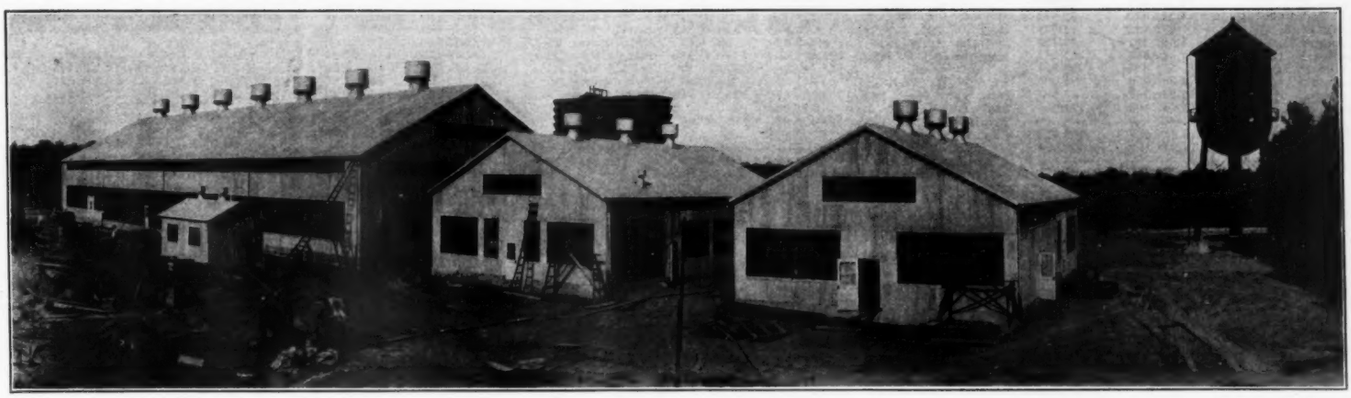


Building for the Gas Industry

Above Booster Pump Station, located at St. Louis, Mo., on a 22-inch gasoline line from Monroe, La., to St. Louis, was erected complete in 90 days by "Pittsburgh-Des Moines" for the Mississippi River Fuel Corp.

Three similar booster stations of five buildings each were also erected by PDM at Perryville, La., Glendale, Ark., and West Point, Ark.

A compressor building (66'6"x196'), an auxiliary building and a warehouse (each 40'x68'), a regulator building (12'x20'), and a pump house (16'x36') comprise each station. A PDM Elevated Water Tank can be seen at the right.

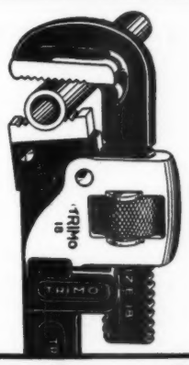
Pittsburgh-Des Moines Steel Company

13 Neville Island
Pittsburgh, Pa.

1225 Praetorian Bldg.,
Dallas, Texas

915 Tuttle St.,
Des Moines, Ia.

New York Atlanta Chicago Seattle San Francisco



Strength - Safety

TRIMO's leadership in the oil fields is based on no trick claims, no flash in the pan wave of popularity.

Strength and safety have made TRIMO first choice. The handle is drop forged not cast — and heat treating gives the extra toughness to stand terrific strain.

TRIMO is made throughout by a company pledged for over forty years to fine tool making.

TRIMONT MFG. CO., INC., Roxbury (Boston), Mass.

TRIMO

TRIMO Pipe Wrench

On the Job— ALWAYS

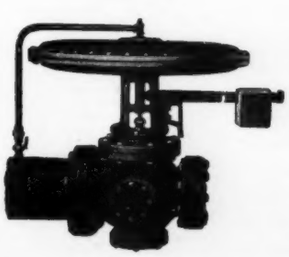
The Chaplin-Fulton Automatic Cut-Off is on the job at all times. It automatically closes the ports of the regulator valve. The valves must be opened by hand before the gas flow resumes.

There is no chance for dangerous explosions, because even though the diaphragm of the regulator should burst, this cut-off would stop the flow of gas immediately.

The Chaplin-Fulton Manufacturing Co.
28-40 Penn Ave. Pittsburgh, Pa.

CF

More than 40 years of experience in controlling gas pressure has taught us how to make this device dependable in its operation.



Organized 1884 —Oldest builders of regulators in the country. Built in all sizes from 1 to 24 inches; for all services 1 oz. up to 2,000 lbs. pressure per square inch.

Oklahoma-Kansas and Eastern Pipe Line Report

OKLAHOMA-KANSAS
Pipe Line Report for Month of December

Runs

	Month (bbls.)	Dly. av. (bbls.)
Prairie P. L. Co.	1,271,000	41,000
Gulf P. L. Co.	1,222,002	39,419
Texas P. L. Co.	679,782	21,929
Magnolia P. L. Co.	1,626,201	52,456
Empire P. L. Co.	1,902,653	61,311
Cosden P. L. Co.	741,249	23,911
Sinclair P. L. Co.	3,007,000	97,000
Oklahoma P. L. Co.	1,250,752	72,605
Other lines	5,549,000	179,000
Total December	18,247,639	588,633
Total November	18,336,190	611,206
Difference	88,551	22,573

Shipments

Prairie P. L. Co.	1,994,387	64,335
Gulf P. L. Co.	276,301	8,913
Texas P. L. Co.	1,037,027	33,453
Magnolia P. L. Co.	1,692,340	54,593
Empire P. L. Co.	1,768,811	57,058
Cosden P. L. Co.	508,332	16,398
Stanolind P. L. Co.	2,957,631	95,409
Oklahoma P. L. Co.	2,364,071	76,261
Other lines	5,301,000	171,000
Total December	17,899,960	577,419
Total November	22,032,627	710,729
Difference	413,667	133,310

Stocks

Prairie O. & G. Co.*	38,358,000
Gulf P. L.-Gypsy Oil Co.	8,401,860
The Texas Company	3,489,849
Magnolia Petroleum Co.	5,700,152
Empire P. L. Co.	5,300,761
Mid-Continent Pet. Corp.	4,286,897
Sinclair Crude Oil Pur. Co.*	18,500,000
Oklahoma P. L. Co.	2,758,031
Carter Oil Co.	10,069,192
Other lines*	22,889,000
Total December	119,753,743
Total November	120,275,702
Difference	521,960

*Estimated. Prairie and Stanolind shipments include Texas oil.

EASTERN PIPE LINE REPORT FOR JANUARY

Runs From Wells

In the following table will be found the regular receipts from wells by various pipe lines in New York, Pennsylvania, West Virginia, Ohio, Kentucky, Illinois, Indiana and Michigan for December and January:

	Dec., 1930	Jan., 1931
Nat. Transit	110,146.31	127,013.27
S. W. Pa. P. L.	72,041.68	75,179.62
Eureka P. L.	289,000.11	292,615.52
Buckeye P. L. (Mackb'g)	325,496.03	311,385.14
Buckeye P. L. (Cleve.)	11,757.62	11,175.80
Buckeye P. L. (Lima, etc.)	82,364.67	91,601.51
Indiana P. L.	3,342.37	3,805.02
Cumberland P. L.	178,692.00	174,361.92
N. Y. Transit	28,548.26	27,836.13
Tide Water P. L.	27,349.30	25,747.93
Pure Oil	204,537.02	220,231.74
Stoll Oil Ref.	14,378.02	.....
Bradford Tran.	319,175.02	310,660.96
East Gulf Oil	7,156.40	.....
Total	1,673,984.81	1,672,114.62
Daily average	53,999.19	53,939.18

Note—Indian Refining Co. had other receipts of 293,705.56 bbls.

Petroleum Deliveries

The following tables exhibit the shipments or regular deliveries of various pipe lines in New York, Pennsylvania, West Virginia, Ohio, Kentucky and Indiana for December and January:

	Dec., 1930	Jan., 1931
Nat. Transit	418,614.12	431,627.59
S. W. Pa. P. L.	243,352.43	311,121.19
Eureka P. L.	268,939.44	333,443.59
Buckeye P. L. (Mackab'g)	247,581.49	257,687.49
Buckeye P. L. (Cleve.)	1,464.51	1,462.63
Buckeye P. L. (Lima, etc.)	1,063,204.74	1,121,462.88
Indiana P. L.	287,189.39	644,291.15
Cumberland P. L.	129,255.52	109,598.07
Southern P. L.	27,773.80	65,326.45
N. Y. Transit	189,599.54	174,756.42
Northern P. L.	78,349.64	230,180.55
Tide Water P. L.	359,965.20	536,454.77
Pure Oil	69,124.29	86,532.61
Indian Ref.	280,245.79	278,699.79
Bradford Tran.	373,859.08	364,290.68
Tuscarora Oil	369,139.82	489,729.45
East. Gulf Oil	5,397.60	.....
Total	4,413,056.40	5,436,465.31
Daily average	143,001.82	175,369.85

Gross Stocks

The gross stocks held by various pipe lines in the oil-producing sections of New York, Pennsylvania, West Virginia, Ohio, Indiana and Kentucky and Indiana at the close of December and January:

	Dec., 1930	Jan., 1931
Nat. Transit	796,609.10	839,235.79
S. W. Pa. P. L.	444,175.42	432,473.26
Eureka P. L.	1,500,225.43	1,548,201.04
Buckeye P. L. (Macksb'g)	643,952.78	597,544.40
Buckeye P. L. (Cleveland)	37,246.45	54,263.96
Buckeye P. L. (Lima, etc.)	4,424,779.87	4,554,991.51
Indiana P. L.	587,459.89	562,567.51
Cumberland P. L.	592,631.01	623,458.27
Southern P. L.	292,250.09	265,515.03
N. Y. Transit	140,232.95	161,624.59
Northern P. L.	515,798.08	368,986.82
Tide Water P. L.	1,049,178.91	979,269.83
Pure Oil	467,768.78	605,621.04
Indian Ref.	55,677.44	70,080.52
Tuscarora	15,325.72	14,447.96
Brad. Trans.	183,944.67	152,811.37
East. Gulf	4,695.82	.....
Total	11,751,952.41	11,831,092.90
Difference	99,428.51	79,140.49

Grades of Oil

The following table shows the amount of the different grades of oil held by the Eastern Pipe Lines at the close of December and January, showing gross stocks of the above fields:

	Dec., 1930	Jan., 1931
Pennsylvania	3,950,817.59	3,904,310.87
Lima	757,684.69	800,240.43
Kentucky	643,036.25	665,271.73
Mid-Continent	5,903,435.98	5,863,671.90
Illinois	40,169.01	3,659.28
Michigan	456,808.89	593,938.69
Total	11,751,952.41	11,831,092.90

Daily Average Runs

The following table shows the daily average runs of the Pennsylvania, Lima and Kentucky oil fields for the past four years:

	1928	1929	1930	1931
Jan.	52,904	51,749	75,907	53,939
Feb.	57,002	51,833	79,256	.....
Mar.	57,485	54,252	76,688	.....
April	56,812	58,444	84,536	.....
May	62,067	59,902	80,548	.....
June	58,230	58,833	75,430	.....
July	57,144	66,087	68,921	.....
Aug.	57,745	66,087	64,291	.....
Sept.	53,487	67,315	56,595	.....
Oct.	58,100	76,093	58,179	.....
Nov.	53,865	74,831	52,332	.....
Dec.	52,025	74,561	53,999	.....

Daily Average Shipments

The following table gives daily average shipments from the Pennsylvania, Lima and other fields for the past four years:

	1928	1929	1930	1931
Jan.	146,465	165,721	217,623	175,369
Feb.	167,368	159,387	224,355	.....
Mar.	158,883	161,474	228,846	.....
April	172,935	169,737	241,845	.....
May	180,559	184,281	248,383	.....
June	188,024	185,404	234,401	.....
July	189,470	194,763	207,094	.....
Aug.	192,853	194,946	205,506	.....
Sept.	194,138	201,214	193,999	.....
Oct.	176,000	191,367	157,675	.....
Nov.	176,898	202,743	146,638	.....
Dec.	173,572	186,257	143,001	.....

Gross Stocks

In the following table will be found the gross stocks of the various lines of the Pennsylvania, Lima and Kentucky oil fields, including oil received from other lines at the close of each month for the past three years:

	1929	1930	1931
Jan.	7,596,564	12,220,045	11,831,092
Feb.	8,738,835	12,991,561	.....
Mar.	9,002,058	13,247,217	.....
April	8,978,172	13,233,961	.....
May	8,903,560	13,052,953	.....
June	8,921,275	13,396,855	.....
July	9,211,595	13,268,562	.....
Aug.	9,440,643	13,047,051	.....
Sept.	9,443,067	12,812,018	.....
Oct.	9,441,101	12,437,555	.....
Nov.	9,868,538	11,851,380	.....
Dec.	11,253,953	11,751,952	.....

The Illinois Field

The following table gives the report of the Illinois Pipe Line Co. in Illinois:

Gross stocks, February 1	1,942,817.13
Runs from wells	442,681.05
Other receipts	157,854.19
Regular deliveries	606,697.37
Other deliveries	200,530.64

The amount of Illinois oil run by the Tide Water Pipe Line Co. in January was 25,747.99 bbls. Deliveries were 62,875.82 bbls. Adding these figures to those of the Illinois Pipe Line Co. makes the runs and deliveries as follows:

	Runs	Deliveries
1931—		
Jan.	468,429.04	669,573.19
1929—		
Feb.	517,320.17	503,387.70
Mar.	728,319.67	586,049.60
April	515,374.27	654,297.96
May	608,981.60	673,812.83
June	568,454.70	818,845.97
July	611,106.79	828,159.44
Aug.	625,351.99	746,425.06
Sept.	582,457.66	669,947.72
Oct.	622,302.83	558,558.68
Nov.	565,108.75	427,064.63
1930—		
Jan.	543,387.95	498,293.93
Feb.	548,416.33	414,536.59
Mar.	631,944.49	469,119.53
April	530,074.22	509,304.60
May	605,147.37	504,069.84
June	572,662.57	468,658.81
July	604,529.54	388,454.47
Aug.	594,642.12	375,742.43
Sept.	457,001.11	371,691.63
Oct.	478,442.12	320,688.73
Nov.	422,794.68	355,403.12
Dec.	556,418.78	363,719.55

Tide Water Pipe Co., Ltd., also delivered in January 270,086.49 bbls. Oklahoma oil.

AVERAGE DAILY RECEIPTS OF CALIFORNIA CRUDE AND REFINED OIL AT ATLANTIC AND GULF PORTS

Average barrels per day in 1930-31—	Atlantic Ports: Baltimore	Boston	New York	Philadelphia	Others	Total	Gulf Coast Ports: Galveston	New Orleans, Baton Rouge	Port Arthur, Sabine Pass	Tampa	Total	Total all ports
February	7,678	.....	24,714	14,321	5,000	51,714	.....	.....	.....	.....	2,607	54,321
March	10,548	3,065	28,871	8,774	22,484	73,742	.....	.....	.....	.....	805	74,548
April	7,767	.....	14,369	11,600	7,433	41,167	.....	.....	.....	.....	7,600	48,767
May	5,194	8,451	28,161	9,484	2,774	54,064	.....	.....	.....	.....	774	54,838
June	8,300	.....	33,933	20,767	2,333	65,333	.....	.....	.....	.....	2,400	67,733
July	17,355	7,774	43,419	23,839	6,452	98,839	.....	.....	.....	.....	4,645	103,484
August	7,418	8,742	38,968	21,226	5,258	81,613	.....	.....	.....	.....	97	81,710
September	6,300	6,400	25,600	13,400	9,567	61,267	.....	.....	.....	.....	2,433	63,700
October	2,516	3,065	27,258	16,419	4,903	54,161	.....	.....	.....	.....	5,355	59,516
November	8,367	6,233	33,800	17,733	4,600	70,733	.....	.....	.....	.....	4,800	75,533
December	5,516	4,323	30,645	9,678	3,580	53,742	.....	.....	.....	.....	4,645	58,387
January	8,387	6,613	21,968	14,678	11,096	62,742	.....	.....	.....	.....	6,129	68,871

AVERAGE DAILY IMPORTS OF CRUDE AND REFINED OIL AT PRINCIPAL UNITED STATES PORTS

Average barrels per day in 1930-31—	Atlantic Ports: Baltimore	Boston	New York	Philadelphia	Others	Total	Gulf Coast Ports: Galveston	New Orleans, Baton Rouge	Port Arthur, Sabine Pass	Tampa	Total	Total all ports
February	24,500	14,714	147,357	36,036	39,786	262,933	2,821	11,072	3,500	1,964	19,357	281,750
March	28,355	4,839	151,806	36,646	34,903	255,548	4,323	11,645	839	2,419	19,226	274,774
April	31,400	8,933	123,500	40,433	19,434	223,700	.....	7,400	2,433	4,167	14,000	237,700
May	24,129	9,322	174,194	39,291	28,226	275,161	8,194	11,548	2,935	1,323	24,000	299,161
June	51,533	15,667	121,067	45,033	25,033	258,333	4,413	17,367	2,167	1,333	25,300	283,663
July	42,097	9,548	154,968	37,935	36,032	280,580	5,678	9,161	2,097	2,387	19,323	299,903
August	35,032	4,484	145,613	33,355	25,097	247,581	8,419	9,323	8,548	3,000	29,290	276,871
September	38,867	8,533	150,933	34,500	25,567	258,400	6,433	12,234	.....	3,800	22,467	280,867
October	19,839	11,742	146,194	35,355	26,967	240,097	6,065	7,067	2,774	2,545	18,451	258,548
November	39,633	35,900	124,633	36,467	24,667	261,300	2,467	7,366	.....	1,767	11,600	272,900
December	21,419	14,033	122,774	32,839	33,774	224,839	6,290	10,613	2,097	290	19,290	244,129
January	17,613	13,519	154,225	32,902	30,612	248,871	2,032	11,677	2,097	3,097	18,903	267,774

GROSS PRODUCTION OF CRUDE OIL IN THE UNITED STATES FOR 12 MONTHS (Revised)

(In Barrels of 42 Gallons)

1930—		California	Oklahoma	Texas	Kansas	Arkansas	Louisiana	Rocky Mts.	Eastern	Total
January:	Month	21,983,242	20,802,984	25,284,352	3,273,197	1,817,685	1,780,751	2,151,090	4,113,000	81,206,301
	Daily average	709,137	671,064	815,624	105,587	58,635	57,444	69,390	132,678	2,619,558
February:	Month	20,885,660	17,977,624	23,314,637	2,965,704	1,608,376	1,738,250	2,027,984	3,963,000	74,481,235
	Daily average	745,916	642,058	832,669	105,918	57,442	62,080	72,428	141,536	2,660,044
March:	Month	19,699,979	19,115,406	25,503,082	3,504,395	1,817,871	1,942,938	2,337,028	4,223,000	78,143,699
	Daily average	635,483	616,626	822,679	113,045	58,641	62,675	75,388	136,161	2,520,764
April:	Month	18,768,743	19,541,310	24,799,763	3,734,253	1,724,460	1,909,552	2,334,810	4,267,000	77,069,891
	Daily average	625,625	651,377	826,659	124,475	57,482	63,652	77,827	141,900	2,568,996
May:	Month	19,044,444	20,587,503	26,219,488	3,978,385	1,659,895	1,907,482	2,565,219	4,414,000	80,376,776
	Daily average	614,337	664,113	845,786	128,335	53,545	61,543	82,749	142,387	2,592,799
June:	Month	18,020,795	19,754,700	25,643,705	3,765,060	1,704,060	1,925,621	2,519,190	4,288,000	77,621,131
	Daily average	600,693	658,490	854,790	125,502	56,802	64,187	83,973	142,933	2,587,371
July:	Month	18,802,024	18,032,514	25,973,521	3,541,409	1,713,680	2,079,769	3,275,894	3,830,000	77,248,811
	Daily average	606,517	581,694	857,856	114,239	55,280	67,089	105,674	123,548	2,491,897
August:	Month	18,770,466	17,162,034	25,069,598	3,491,530	1,700,102	2,151,120	3,193,341	3,417,000	74,955,191
	Daily average	605,499	553,614	808,696	112,630	54,842	69,391	103,011	110,226	2,417,909
September:	Month	17,984,306	16,509,120	23,111,822	3,405,510	1,583,280	2,008,060	3,239,010	3,396,000	71,237,108
	Daily average	599,477	550,304	770,394	113,517	52,776	66,935	107,967	113,200	2,374,570
October:	Month	18,244,053	16,632,523	23,626,553	3,571,913	1,636,552	2,142,885	3,225,550	3,627,000	72,707,029
	Daily average	588,518	536,533	762,147	115,223	52,792	69,125	104,050	117,000	2,345,388
November:	Month	18,109,459	14,941,770	22,035,222	3,459,330	1,557,870	2,136,948	2,957,100	3,222,000	68,419,699
	Daily average	603,648	498,059	734,507	115,311	51,929	71,231	98,570	107,400	2,280,656
December:	Month	17,786,728	15,057,103	21,810,359	3,432,661	1,590,951	2,157,534	3,118,663	3,328,000	68,281,999
	Daily average	573,765	485,713	703,560	110,731	51,321	69,598	100,602	107,355	2,202,645
	Total 12 months	228,099,899	216,114,591	292,392,102	42,123,347	20,114,782	23,881,270	32,944,879	46,078,000	901,748,870
	Daily average	624,931	592,095	801,074	115,406	55,109	65,428	90,260	126,241	2,470,545